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ABSTRACT

The report presents case studies of microcomputer use in 12 school districts' special education programs. The case study approach was designed to focus on organizational issues, specifically the following four: nature of collaboration between regular and special education, centralization or decentralization of decisionmaking in implementation phases, cooperation between administrators and educators regarding application (administrative vs. instructional), and training in the use of microcomputers. An initial section analyzes data across the case studies. Major findings include overall collaboration in the use of microcomputers between special and regular education, especially, at the building rather than district level; the importance of a small team approach to implementation; lack of conflict between administrative and instructional applications in microcomputer systems; and emerging trends in designation of a coordinator to supervise implementation. Each of the 12 case studies reports on program development and chronology, features of the microcomputer system, and organizational aspects. (CL)

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**Microcomputers
in the Schools --
Implementation
in Special Education**

CASE STUDY REPORT

**SRA Technologies
and
Cosmos Corporation**

EC161138

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**Microcomputers in the Schools --
Implementation in Special Education**

CASE STUDY REPORT

Submitted to

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September 15, 1983

MICROCOMPUTERS IN THE SCHOOLS--
IMPLEMENTATION IN SPECIAL EDUCATION

Case Study Report

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MICROCOMPUTERS IN THE SCHOOLS--
IMPLEMENTATION IN SPECIAL EDUCATION

Case Study Report

November 3, 1983

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PREFACE

Computer-assisted instruction (CAI) has been demonstrated as effective with handicapped students (Cartwright & Hall, 1974; Carmen & Kosberg, 1982; Hasselbring, 1982). Further, indirect support for CAI with special populations can be derived from findings reported in more general research. Reviewers have noted that the strongest positive effects of CAI were measured in lower level coursework (Hartley, 1977; Kulik, 1981) and in instruction for "disadvantaged" (Jamison, Suppes, & Wells, 1974) or lower functioning students (Kulik, Bangert, & Williams, 1983).

In addition, there is a growing consensus and enthusiasm for the use of microcomputers in special education programs (Hofmeister, 1982; Taber, 1983), beyond the generally applicable (for all populations) advantages of CAI (Budoff & Hutton, 1982; Roblyer & King, 1983; Torgesen & Young, 1983). The salient features include:

- an ability to structure software to meet predetermined objectives;
- a heightened efficacy of "drill-and-practice" exercises with some students;
- the escaping of the long history of failure with workbooks;
- a nonthreatening instructional interaction;
- a failure-free mastery of new skills;
- the engaging and attention-keeping ability of microcomputers;
- the reinforcement and support for prior learning; and
- the savings in time spent to reach instructional objectives.

Microcomputers have also been targeted as potentially beneficial tools to assist educators in the myriad of information management tasks associated with school administration. In particular, the extensive record-keeping requirements associated with P.L. 94-142 have generated much

interest in administrative applications of microcomputers (Whitney & Hofmeister, 1981).

Given the potential for the use of this new technology in special education, this study has been sponsored by the Special Education Programs division of the U.S. Department of Education. The project, which includes both research and information development components, is being conducted by SRA Technologies, Inc. of Arlington, Virginia, and COSMOS Corporation of Washington, D.C. During the spring of 1983, twelve case studies of microcomputer implementation were conducted in school districts across the country.

The case study method used in this research focused on organizational issues, and especially the following major issues:

- the nature of the collaboration between special and regular education in implementing microcomputer use;
- the centralization or decentralization of decision making in different stages of implementation--planning, adoption, purchasing, training, coordination, etc.;
- the nature of cooperation between administrators and educators vis-a-vis instructional vs. administrative applications; and
- training in the use of microcomputers and roles that emerged to foster use of the technology.

These issues were examined individually in each case study and also analyzed across the cases.

This report is in two parts. The first is a cross-case analysis and summarizes the major results and findings synthesized from the individual case studies. The second part consists of the twelve case studies. During 1983-1984, the information collected and analyzed in this research will serve as a basis for an extensive dissemination effort, to assist special educators in using microcomputers appropriately.

For purposes of simplicity, the 12 school districts are identified by one-word names;

Abingdon	Washington County School District, Abingdon, Virginia
Boise	Independent School District of Boise City, Boise, Idaho
Cheyenne	Laramie County School District Number One, Cheyenne, Wyoming
Commack	Commack Union Free School District, Commack, New York
Hopkins	Hopkins School District Number 270, Hopkins, Minnesota
Lexington	Minuteman Regional Vocational Technical School District, Lexington, Massachusetts
Linden	Linden School District, Linden, Michigan
Oakhurst	Township of Ocean School District, Oakhurst, New Jersey
Pittsburg	Pittsburg Unified School District, Pittsburg, California
Prescott	Prescott Unified School District Number One, Prescott, Arizona
Shelby	Shelby City School District, Shelby, Ohio
Tallulah	Madison Parish School System, Tallulah, Louisiana

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SCHOOL DISTRICTS AND
THEIR MICROCOMPUTER "SYSTEMS"

Cross Case Report

I. INTRODUCTION

The topic of microcomputer implementation in schools is unusually difficult to study. Microcomputers are independent, self-standing units, and their use in schools can involve: a) the units independently, b) the units as part of larger "systems," or c) both.

In studying independent units, the major implementation issues tend to deal with classroom management--e.g., the ways in which teachers may arrange schedules for student use or locate the unit within the classroom. Although such issues may be important in explaining educational outcomes, they are not as relevant in guiding district policy on such questions as:

1. Should all the microcomputers in the district be of the same brand of hardware, or is some mix of brands justifiable or even advantageous?
2. Should the microcomputers all be purchased at the same time, or at regular annual intervals in an incremental fashion?
3. How have microcomputers been used for students with special needs--e.g., the handicapped--and how has the district's administration of regular and special education changed, if at all?
4. How should the microcomputers in a district be supervised--on a centralized or decentralized pattern?
5. What patterns have evolved in using microcomputers for administrative vs. instructional applications?
6. What kind of training tends to facilitate the implementation process and the development of microcomputer use?
7. Are new administrative or supportive roles emerging which districts may need to anticipate?

From the standpoint of these types of questions, a study must deal with the various microcomputer "systems" that may exist within a district, and not necessarily focus on individual units.

The present investigation, based on case studies of microcomputer use in twelve school districts (see Table I-1 for a summary of the districts' characteristics), was mainly oriented toward these organizational and administrative issues, and therefore concentrated on the experiences with microcomputer "systems," and not simply individual units. Yet, such an emphasis raises new questions, not readily answerable, having to do with the definition of such "systems." Section II deals with this definitional problem and also addresses Questions 1 and 2 above. Questions 3, 4, and 5 are then the topics of separate sections (III, IV, and V), while Questions 6 and 7 are covered together in Section VI of this report.

Table I-1
District Characteristics

Abingdon School District

- a. Abingdon, Virginia
- b. Southwest Virginia (9th District)
- c. Suburban/Rural
- d. Lower and middle
- e. 8,800 (stable)
- f. Predominantly White

Boise School District

- a. Boise, Idaho
- b. Southwest Idaho (1st & 2nd Districts)
- c. Urban/suburban
- d. Middle
- e. 21,000 (stable)
- f. Predominantly White

Cheyenne School District

- a. Cheyenne, Wyoming
- b. Southeast Wyoming (At Large)
- c. Urban/rural
- d. Middle
- e. 13,000 (stable)
- f. Predominantly White

Commack School District

- a. Commack, New York
- b. Long Island (3rd District)
- c. Suburban
- d. Upper middle
- e. 9,200 (declining)
- f. Predominantly White

Hopkins School District

- a. Hopkins, Minnesota
- b. Minneapolis area (3rd District)
- c. Suburban
- d. Middle
- e. 6,900 (slightly declining)
- f. Predominantly White

Lexington Regional District

- a. Lexington, Massachusetts
- b. Boston area (7th District)
- c. Suburban
- d. Upper middle
- e. 1,250 (stable)
- f. Predominantly White

Linden School District

- a. Linden, Michigan
- b. Flint area (7th District)
- c. Suburban/Rural
- d. Lower middle
- e. 2,500 (slightly declining)
- f. Predominantly White

Oakhurst School District

- a. Oakhurst, New Jersey
- b. New Jersey Coast (3rd District)
- c. Suburban
- d. Upper middle
- e. 4,150 (declining)
- f. Predominantly White

Pittsburg School District

- a. Pittsburg, California
- b. East Bay area (7th District)
- c. Suburban
- d. Middle and lower
- e. 6,000 (stable)
- f. Mixed

Prescott School District

- a. Prescott, Arizona
- b. Near Phoenix (3rd District)
- c. Suburban/rural
- d. Middle
- e. 4,450 (stable)
- f. Predominantly White

Shelby School District

- a. Shelby, Ohio
- b. North Central Ohio (4th District)
- c. Suburban/rural
- d. Middle
- e. 2,800 (stable)
- f. Predominantly White

Tallulah School District

- a. Tallulah, Louisiana
- b. Near Jackson, Mississippi (5th District)
- c. Suburban/rural
- d. Lower
- e. 3,800 (slightly declining)
- f. Predominantly Black

LEGEND: a. City, State	d. Income Level
b. Location (and Congressional District)	e. Student Population (and Trend)
c. Suburban/Urban/Rural	f. Ethnic Composition

II. CHARACTERISTICS OF MICROCOMPUTER "SYSTEMS"

What is a Microcomputer "System?"

A microcomputer "system" may be defined by the existence of several decisionmaking patterns:

- Coordinated decisions have been made for the initial purchase of the microcomputers;
- Coordinated decisions have been made for the upgrading of these units or their augmentation by subsequent purchases;
- Coordinated decisions have been made regarding the allocation of the microcomputers to different physical locations, to different subject topics, or to meet various scheduling needs;
- Some functional interdependency exists among the units--e.g., in the formal sharing of software or the provision of maintenance services; and
- Some common arrangement has been made to provide user training.

All of these characteristics will not be found in all cases. However, the more that the same set of microcomputers has these characteristics, the more that the units may be considered part of the same system.

This notion of microcomputer "systems" is needed to study microcomputers from an organizational point of view and to consider the related implementation issues. Even with an explicit definition, however, a precise enumeration of the microcomputers within a given system may still not be possible in all cases. For example, an individual microcomputer unit may be purchased by a local parent-teacher association, to be placed in a specific school. The unit may then share some of the same software already in the school. In such a case, whether this unit is considered part of the same or different microcomputer system is rather arbitrary. In spite of such instances, however, the overall definition of microcomputer "systems" is still useful for identifying those microcomputers that fall

within the same decisionmaking and organizational context.

Characteristics of Microcomputer Systems Studied

This definition also allows an analyst to understand that there may indeed be more than one microcomputer system within the same school district. One group of microcomputers may have been purchased and administered for one general purpose (e.g., instructional applications), and another group may have been purchased and administered for some other general purpose (e.g., administrative applications). The implementation pattern for both groups may be different, and neither system may have much to do with the other.

Selection of Systems to be Studied. In the present investigation, the goal was to focus on the microcomputer system used for special education in any given school district. Thus, the procedure for selecting the cases to be studied was based on the characteristics of these particular microcomputers, and not any of the others that also might have been present in the same district.

A nomination procedure was developed, whereby special education staff were contacted in numerous school districts, to determine whether microcomputers were being used for such purposes. If they were, two other criteria were used to select the final districts to be studied: a) the special education microcomputers had to have been in place for three semesters or longer, and b) the special education microcomputers had to have been used for a mix of instructional and administrative patterns across cases. The first criterion was used to assure that the implementation process had proceeded sufficiently to produce adequate information for study--i.e., the investigation was not to be limited to the early adoption experience of school districts. The second criterion was used to assure coverage of a major implementation issue, as described in greater detail in Section V of this report.

Summary Characteristics. Given this procedure, twelve case studies were conducted, each focusing on a microcomputer system within a school district. Table II-1 summarizes the basic characteristics of these systems.

The case studies revealed great diversity in the size and functions of each of the microcomputer systems. Even though all were used for special education, only a few were dedicated solely for that purpose (Abingdon, Linden, and Tallulah); in most cases, the microcomputers were shared between special and regular education applications, with the proportions often not clearly specifiable due to the extensive interaction between

Table II-1

Microcomputer Characteristics

Abingdon School District

- a. 23 Apple II-Plus
- b. 1979
- c. ESEA Title IV-C
- d. 23 Apple II-Plus

Boise School District

- a. 7 Apple II-Plus
- 2 Bell & Howell Apple
- 2 Commodore 64
- b. 1979
- c. ESEA Title IV-C
- Donations
- Parent Teacher Organization; District Budget; Gifted Program
- P.L. 94-142
- d. 14 TRS-80
- 24 Cromemco C10

Cheyenne School District

- a. 44 Apple II-Plus
- 14 Commodore PET
- 66 TRS-80
- 2 Altair
- 4 Commodore 64
- b. 1979
- c. Chapter 1
- Chapter 2
- District Budget
- Association for Students with Learning Disabilities
- d. 3 Commodore W/P 8082
- 5 Commodore CBM 2001
- 1 Apple II-Plus

Commack School District

- a. 55 Commodore PET
- 1 Texas Instrument
- 1 Apple II-Plus
- b. 1978
- c. ESEA Title IV-C
- ESEA Chapter 1
- District Budget
- Parent Teacher Association P.L. 94-142
- d. 2 Commodore 8032
- 13 CompuColor

Hopkins School District

- a. 117 Apple II-Plus
- 3 TRS-80
- b. 1978
- c. P.L. 94-142
- ESEA Title IV-C
- District Budget
- Parent Teacher Organization
- d. None

Lexington Regional District

- a. 22 Apple II-Plus
- b. 1980
- c. P.L. 94-482
- d. 5 Heathkit

Linden School District

- a. 12 Commodore PET
- 2 Apple II-Plus
- b. 1979
- c. Local Fundraising
- P.L. 94-142
- ESEA Title IV-B
- d. 9 Commodore PET

Oakhurst School District

- a. 37 Commodore PET
- 1 Commodore CBM
- 1 Atari
- 1 VIC 20
- b. 1979
- c. Title I/Chapter 1
- Title II/Chapter 2
- Gifted/Talented
- d. 5 Commodore PET
- 3 Apple II-Plus

Pittsburg School District

- a. 10 TRS-80
- 4 Apple IIe
- b. 1982
- c. State Vocational Education Funds
- P.L. 94-142
- Chapter 2
- District Budget
- Local Fund raising (e.g., parents group)
- Emergency School Aid Act
- d. 5 Intertec Compustar
- 2 Apple II-Plus
- 1 CompuPro
- 5 TRS-80

Prescott School District

- a. 298 Commodore PET
- b. 1979
- c. ESEA Title IV-C
- State Vocational Education Program
- District Budget
- d. None

Shelby School District

- a. 9 TRS-80
- 4 Apple II-Plus
- 4 Commodore PET
- 1 Apple IIe
- b. 1980
- c. ESEA Title IV-C
- Gifted/Talented State Funds
- ESEA Title IV-E
- Principal's Budget
- ESEA Title VI-B
- Parent Teacher Organization; Local Fund raising
- d. None

Tallulah School District

- a. 2 Intertec Compustar
- b. 1978
- c. P.L. 94-142
- d. 1 TRS-80
- 9 Commodore PET

LEGEND: a. Number and type of microcomputers in system studied	c. Major funding source for microcomputers studied
b. Year of initial use of microcomputers in system studied	d. Number and type of other microcomputers in district, not studied

these programs in a district. This characteristic and the related educational and administrative issues are discussed further in Section III.

In addition, the microcomputer systems were indeed not necessarily the only microcomputers in the same district. Other microcomputers also co-existed, being part of different systems. In fact, in only three of the cases were the microcomputer systems studied the only systems in the district (Prescott, Shelby, and Hopkins). Thus, Table II-1 indicates the number of microcomputers in each system, as well as the number of units in other systems in the same district.

Table II-1 also captures two other salient characteristics worthy of further discussion. First, the microcomputers within the same system need not be of the same brand of hardware. Indeed, in only three of the cases (Prescott, Lexington, and Abingdon) did the system consist of only one brand of hardware. The diversity of brands within the same system can create coordination problems, as in the case of one district (Shelby). However, such diversity also can be desirable.

For instance, different brands of hardware may have different strengths and weaknesses regarding different applications--e.g., wordprocessing as an instructional tool vs. drill-and-practice routines vs. lessons in computer education (e.g., LOGO). If a district knows it will be undertaking such diverse applications, this may very well justify the purchase of different types of hardware, and coordination problems may be minimized because the applications will involve different teaching staffs and classrooms. Such diversity also has one additional benefit: The units for one type of hardware will be "secure" in relation to the units for another type of hardware. Thus, if specific administrative applications (e.g., grades, test scores) are to be part of the overall microcomputer system, these applications will not be threatened by tampering if they involve a different brand of hardware from the other microcomputers.

Second, the microcomputers within the system have been supported by a diverse array of funding sources. These funds appear to equally reflect federal and state as well as local sources; among the federal sources, both categorical and block grants were used, and among the local sources, both district revenues and funds from voluntary efforts were used. The diversity is probably a reflection of the relatively low cost of a single microcomputer unit. Thus, different units within the same system may have nevertheless been purchased with funds from different sources.

"Cohorts" of Microcomputers?

Table II-1 also indicates the initial year in which the microcomputers studied were purchased. For all the districts except Pittsburg, this year was 1980 or earlier, reflecting one of the criteria for selecting the district to be part of the study in the first place. (In Pittsburg, the system studied began in 1982, because the initial system upon which the site screening had taken place had ceased to exist.)

What the table does not indicate is that in none of the cases were the microcomputer units all purchased during this first year. Indeed, one of the most salient characteristics throughout all of the cases is that microcomputer systems have been growing in an incremental manner. Some typical examples are illustrated in Table II-2, showing how annual purchases have varied in nine of the cases (the same variations also existed in the other three cases, but the precise numbers of units per year were not available).

The new units each year may represent a commitment to a new curriculum topic or grade level. For instance, a district may have purchased ten microcomputers in one year, to provide all resource rooms at the junior high school level with one unit. The following year, the district may have purchased 12 more units, and initiated computer "labs" of three units a piece in four elementary schools. Next, the district may have purchased 12 more units, and divided them in some manner among junior high school students who are not assigned to resource rooms (and who therefore had no access to the first year's microcomputers).

As the preceding example suggests, the total microcomputer system ultimately represents a collection of different "cohorts" of microcomputer units. This type of incremental change allows the district to absorb increasing numbers of microcomputers at a reasonable pace, so that training, curriculum development, and software activities can be focused each year on a different set of topics or teaching staff. Such incremental growth therefore minimizes the disruption to the entire school district and enables a small group of district staff to coordinate the entire microcomputer system.

Summary

This section has described the basic characteristics of the microcomputers studies in twelve school districts. First, the focus of study was a collection of "system" of microcomputers in each school district. The relevant system was deemed the one serving special education, although other systems may also have existed within the same district. Second, even within a single

Table II-2
Years of Purchase of Microcomputer Units

DISTRICT	Year:	I	II	III	IV	V
Abingdon		2	3	15	3	-
Boise		2	2	1	4	3
Hopkins		1	17	34	17	54
Lexington		2	10	9	1	-
Linden		3	4	6	2	-
Oakhurst		14	-	14	12	-
Prescott		40	10	40	31	177
Shelby		5	3	7	3	-
Tallulah		1	-	-	1	-

system, the brands of microcomputer hardware could vary, with such variations taking advantage of different capabilities for different types of applications. Third, each system represented annual increments of new microcomputer units, rather than a massive, initial installation.

The remaining sections of this report analyze specific organizational or implementation issues regarding these twelve microcomputer systems.

III. SPECIAL EDUCATION USE OF MICROCOMPUTERS-- COLLABORATION OR SPECIALIZATION?

The case studies examined both the nature of microcomputer applications used to support special education services and the type and extent of collaboration that occurred between regular and special educators in the use of the microcomputers.

As a hardware technology that can be shared by many users, microcomputer systems may be considered natural candidates for substantial sharing between special and regular education programs. However, the distinctive needs of special education students could arguably lead to less sharing. For instance, for students with communicative disorders, special devices may have to be used and the microcomputer units themselves may require special adaptations. Similarly, the distinctive administrative needs of special education programs may also mean that a lesser degree of sharing is possible. Thus, case studies were designed to examine collaborative activities across a variety of stages in implementation, and across time--planned interaction versus actual interaction. Finally, the case studies also investigated the particular benefits or problems that resulted from collaboration.

The school districts were selected to represent a variety of possible collaborative approaches. As shown in Table III-1, the majority of the microcomputer systems involved shared usage by both regular and special education--even if they had not started out that way. Only three systems (Abingdon, Linden, and Tallulah) had restricted their microcomputer implementation to special education applications.

Participants in Initial Adoption of Microcomputers

Patterns of initial microcomputer adoption varied a great deal. In three systems (Cheyenne, Oakhurst, and Shelby), the initial adoption did include special education applications but, nevertheless, no special educators were involved in planning the original implementation.

In systems where special educators were involved in planning for the initial adoption of microcomputers, two patterns occurred. In three systems (Boise, Linden, and Tallulah) only special educators participated in planning the initial adoption. In all of these cases, the original applications were designed exclusively for special education use. Thus, collaboration in initial adoption, between special and regular education, occurred only in the remaining three systems:

Table III-1

Special and Regular Education
Sharing of Microcomputer Applications

Type of Applications	Participants in Applications (School Districts)	
	Special Education Only	Special and Regular Education
Instructional	Abingdon Linden	Boise Cheyenne Commack Hopkins Lexington Oakhurst Pittsburg Prescott Shelby
Administrative	Boise Oakhurst Tallulah	Cheyenne Commack Hopkins Lexington Pittsburg Prescott Shelby

Abingdon--a high school industrial arts teacher
and a high school special education
teacher;

Commack--a district administrator and an elemen-
tary special education teacher; and

Lexington--a district administrator and a high
school special education teacher.

In one of these cases (Abingdon), the planned adoption was for special education students only. In the other two (Commack and Lexington) both special and regular education students were targeted.

This variety of patterns indicated that collaboration between special and regular education, during initial planning and adoption, was not a requirement for subsequent sharing of the resources. Actually, initial adoptions were more often characterized by enthusiasm and initiative of a few individuals who were very interested in the potential usefulness of microcomputers in education. These initial adopters included both administrators and teachers, and they came from both special and regular education programs. In a few cases (Boise, Cheyenne, and Tallulah) the initial adoption involved only one individual. In the other cases, the interactions were between individuals, rather than between organizational units in the school district. In none of the initial adoptions was there a formal collaboration between district-level special and regular education programs.

Later Collaborative Patterns

Table III-2 compares the collaboration of special and regular education personnel, at district and building levels, in subsequent stages of implementation: purchases, allocation, coordination, training, and software decisions. During the growth of the systems, some district level collaboration occurred, primarily over purchases and allocation. In four districts (Hopkins, Oakhurst, Pittsburg, and Shelby), centralized special education administration provided funds for the purchase of additional microcomputers. In all but one of these (Hopkins), district staff also decided where these additional microcomputers would be placed. In Hopkins, district funds were made available to support the purchase of microcomputers that were requested by the principals.

The only district level collaboration in training occurred in Oakhurst. The special education department provided funds

Table III-2
 Special and Regular Education Collaboration
 During Subsequent Stages of Implementation

Special and Regular Education Collaboration

DISTRICT	Purchases	Allocation	Coordination	Training	Software
Abingdon			B/T	B/T	B/T
Boise	B/T	B/T	B/T	B/T	B/T
Cheyenne				B/T	B/T
Commack	B/T		B/T		B/T
Hopkins	D			B/T	B/T
Lexington		B/T	B/T	B/T	B/T
Linden					B/T
Oakhurst	D	D		D	B/T
Pittsburg	D	D			B/T
Prescott			B/T		B/T
Shelby	D	D			B/T
Tallulah	--	--	--	--	--

Key: B/T = Building/Teacher Level

D = District Level

-- = No collaboration between special and regular education

for the purchase of 14 microcomputers during the second year of the district's microcomputer implementation. Because these microcomputers, as well as previous units in the district, would now also be used to support CAI with special education students, a special series of the district's training program was set up for the special education teachers. However, the trainers and the curriculum for this inservice were identical to the regularly offered microcomputer inservice. Only the group scheduling was unique--to attract and accommodate as many special education teachers as possible.

Overall, there was greater collaboration between regular and special educators at the building level. In many districts (Abingdon, Boise, Commack, Lexington, Prescott), both groups of teachers interacted in management decisions (coordination, scheduling) related to the microcomputers. Similarly, local training efforts often included both special and regular education teachers as trainers (Abingdon, Boise, Cheyenne, Hopkins, and Lexington). In all studied systems that included instructional applications (Tallulah--administrative only--was the sole exception), special and regular education teachers shared their software. This occurred even in Abingdon and Linden, where the target systems were intended only for special education students. In those cases, special education teachers made software available to other teachers who were interested in using microcomputers, or were just getting their own (independent) microcomputer systems underway.

The Overall Pattern: Collaboration

Taken together, these findings on level, nature, and extent of collaboration did not reflect a strong differentiation between special and regular education use of microcomputers. Identical or similar microcomputers and software were used, with reported success, by both regular and special educators. The inservice training offered was also identical, and equally effective, for both groups of users.

These results may be surprising to those who claim that the instructional use of computers with handicapped children makes requirements for uniquely different applications of the technology (than, say, for use with non-handicapped). However, a review of recent literature in this area (e.g., Taber, 1983; Hofmeister, 1982; Budoff & Hutton, 1982; Hannaford & Taber, 1982, for special education applications--Cohen, 1982; Kulik, Bangert, & Williams, 1983; Steinberg, 1983, for general applications) does not distinguish any general differences between the components of CAI considered important for either group. Microcomputer applications with some selective populations (e.g., severely handicapped and communications

disorders) may require special adaptations of the technology; but the bulk of "handicapped" students are only minimally subnormal (e.g., educable mentally retarded) or impaired in only certain faculties (e.g., specific learning disabilities).

In fact, the approaches advocated for instructional use of microcomputers, and the advantages attached to their use (individualization, prescriptive diagnosis, consistency, etc.), are not just the aspects of a generally sound instructional method, but also the key components of educational approaches currently favored by special educators.

It should be noted that the sample of school districts studied in this investigation was purposive and not random. Districts were selected because of their history of use of microcomputers in special education. Overall, there may be a higher frequency of regular education issues, with no concomitant special education need, than reflected by our cases. Thus, the broader level of collaboration may not be as high as in our cases. For instance, recent surveys (Euchner, 1983) have indicated that the principal use of microcomputers in most districts is for computer programming and computer literacy, and these may have dominantly precluded any participation on the part of special education.

Illustrative Special Education Applications

Independent of the collaborative issue, some of the special education applications of microcomputers are worth noting.

In the administrative area, there are only a limited number of instances when an application included features particularly tailored to special education needs. Two districts (Prescott, Tallulah) used custom-designed IEP development and monitoring systems. (A few other districts indicated that they were planning IEP systems, but had not yet implemented them.)

In the instructional area, one system (Boise) used a microcomputer as a communication aide for a severely handicapped (traumatic spinal injury) student. The unit had been fitted with a special keyboard grid to permit the student, who had limited dexterity control, to type input. Also in Boise, velcro strips were used on some keyboards to "hide" nonessential characters that might be distracting for some students.

In a few cases, special education teachers remarked that there were particular features of some software that were better suited to handicapped students. In particular, one feature commonly mentioned was large, clear letter-forms. Teachers felt this was especially helpful for visually handicapped youngsters,

but was also helpful for students with low ability or attention levels. Some teachers also felt that color-coded letters on the keyboard were also helpful.

Nevertheless, with the few exceptions just noted, applications of microcomputers did not generally differ substantively between regular and special education users. However, some differences were noted in the perceived impact and value of applications. First of all, regarding administrative applications, special educators in many systems (Commack, Hopkins, Lexington, Pittsburg, Prescott, Shelby, Tallulah) reported that microcomputer capabilities were especially useful in light of the record-keeping and report generation requirements related to P.L. 94-142. Similarly, some (Hopkins, Tallulah) also noted the benefits of word processing/mailling list features for regular communication with parents.

Second as a motivational benefit, teachers in two districts (Oakhurst, Commack) cited specific cases of emotionally disturbed children whose behavior and academic performance were markedly improved, they felt, as a function of the introduction of microcomputers. Teachers also believed (Commack, Cheyenne) that typing skills were very important for development of eye-hand coordination by, for example, students with learning disabilities. These teachers used educational software that focused on learning and practicing typing-keys as part of their instructional approach with these students.

Another "normal" function of microcomputers that was viewed to have special benefits for handicapped students was word processing. In Cheyenne, word processing was taught to regular high school students to improve their writing/composition skills in English and journalism classes. However, a junior high school special education teacher, who knew about the success of the high school project, also introduced word processing (Bank Street Writer) with her LD students. She felt that word processing was extremely helpful with these students whose previous writing had been characterized by failure and frustration. The microcomputer was a nonthreatening tutor, and special features (spelling checks, ability to correct errors) encouraged the students to improve their writing and reading.

Conclusion

The implementation of microcomputers in special education was accompanied by considerable collaboration between special and regular education personnel. This collaboration was most evident at the building (rather than district) level, where special and regular education teachers shared microcomputer resources (hardware and software) and participated equally in

coordination and training activities.

Across the systems studied, an examination of the training offered, and the features of inservice that were best received, disclosed no differences between that provided to regular or to special educators. Both groups had some complaints about the microcomputer equipment and software, but their suggestions and criticisms were generally similar. If anything, special education and remedial education (such as basic skills) teachers were more pleased and made more use of the microcomputers than other teachers (except for secondary math/computer science staff).

Finally, there were few examples of unusual or special uses of microcomputers with handicapped students. For the most part, CAI applications with special and regular education students were highly similar--in terms of equipment, methods, and preparation. At the same time, the few instances of special applications (communication aide) or adaptations (modified keyboards) were recognized as highly effective by users, and the selection of cases did not include special schools for the severely handicapped, which may have established a wider array of special applications.

The purposive selection of case study sites did not permit inclusion of special school systems for the severely handicapped or of small microcomputer systems (within regular districts) that concentrated on unusual or specialized adaptations of microcomputers. Microprocessor technology offers great potential usefulness in this area--providing special solutions to the needs of students with major disabilities (Vanderheiden, 1982). The current investigation documented the growth and efficacy of more typical microcomputer applications with special education students who, for the most part, were receiving their educational services in regular elementary and secondary public schools. In the future, introduction of more advanced and specialized microcomputer applications should increase the opportunities for more handicapped students to participate in the educational mainstream.

IV. SUPERVISING THE MICROCOMPUTERS FROM THE TOP DOWN, OR THE BOTTOM UP?

Because a microcomputer is a small, self-standing unit, it can be adopted by a single classroom or by a school building. Alternatively, several microcomputer units can be purchased by a district administration and placed in school buildings.

As a result of these options and their variations, an important issue about microcomputers in schools is whether a centralized approach (i.e., district control) is more or less advantageous than a decentralized approach (i.e., classroom or building control). Such a choice is one of the distinctive characteristics of microcomputer systems, due to the fact that earlier computer systems--such as on-line terminals linked to minicomputers or mainframe computers--frequently did not allow the same decentralized option.

Defining Supervisory Patterns

To examine this issue, the case study protocol called for careful documentation of the precise supervisory patterns in each district. Several activities were traced, to determine which staff made the following types of decisions:

- The decision to purchase microcomputers;
- The allocation of microcomputers to specific classrooms;
- The review and purchase of software for the microcomputers; and
- The arrangements, if any, for training of microcomputer users.

The more these decisions were in the hands of district staff, the more that the microcomputer system was regarded as a centralized (top-down) system; the more these decisions were in the hands of principals and teachers, the more the system was regarded as a decentralized (bottom-up) system.

In tracing these activities, one complication was that the decision-making patterns could change over time. This occurred in most of the case studies, with key personnel--e.g., as the

person ultimately serving as a "microcomputer coordinator"--shifting from one level to another (e.g., Commack), or with supervision over the microcomputers gradually shifting from one level to another (e.g., Hopkins). However, in only two of the districts were such changes on the more drastic side. In one (Cheyenne), the microcomputers were originally supervised in a more decentralized manner, with the district staff playing a minimal role in coordinating purchases and utilization at the building level; however, the district has gradually asserted more control by appointing a coordinator and, in the past year, the Superintendent called for a freeze on all microcomputer purchases so that the entire system could be reviewed. In the other (Pittsburg), the microcomputers have shifted in the opposite direction, with the teaching and building staffs being more active now than before.

For the other ten districts that were studied, however, there was a generally consistent pattern of centralized or decentralized supervision, summarized in Table IV-1. As the table indicates, six of the ten districts are currently organized on a centralized basis, four on a decentralized basis, and two have followed the changing pattern noted above. This cross-case pattern is revealing, even on a descriptive level alone, as an initial conclusion is that:

- No pattern of centralization or decentralization dominated the supervision of microcomputers in the twelve case studies.

Furthermore, our suspicion is that this type of diversity probably exists throughout other school districts across the country.

Examples of Different Supervisory Patterns

A typical centralized pattern of supervision arises when the superintendent or other district-level staff person has an early role in adopting and implementing the microcomputer system. The initial interest may have come from this level or from the building level, but the district staff takes the leadership in all phases of managing the new microcomputer system--i.e., allocating the units to different buildings or classrooms, scheduling training, and reviewing and purchasing software. Moreover, the district staff is then involved in further purchases of new microcomputers in subsequent years, as the system grows. Among the case studies, this most centralized pattern was found in Tallulah, Lexington, and Oakhurst.

Table IV-1

MICROCOMPUTER SUPERVISION PATTERNS

DISTRICT	Type of Supervisory Pattern		
	Centralized	Decentralized	System Changing
Abingdon		X	
Boise		X	
Cheyenne			X
Commack	X		
Hopkins	X		
Lexington	X		
Linden		X	
Oakhurst	X		
Pittsburg			X
Prescott	X		
Shelby		X	
Tallulah	X		

A decentralized pattern can also involve district staff, but at most in an approval capacity only. Thus, a group of teachers and their principal may have the initial interest in adopting a microcomputer; the district staff may help to identify the available funds, but the entire supervision of the units and their use then occurs at the building level. The funds, as in one case (Abingdon), may be "project-specific" (e.g., ESEA Title IV-C), and the microcomputers will be used within the context of a specific, time-limited project (e.g., for three years). In this sense, the district staff have participated in adoption only, and the system is largely outside of their control once it has been purchased.

Both the centralized and decentralized patterns can have their disadvantages. A centralized pattern, in the later years, can lead to situations in which the microcomputers are purchased and assigned with little regard to the needs or training of the teaching or building staff. In one centralized case, for instance, the microcomputer use has not necessarily been closely integrated with daily lesson plans (Prescott).

Similarly, under the decentralized pattern, the subsequent growth of the system may be sporadic. Other microcomputers may be purchased, but only if another group of teachers takes the initiative; and if these teachers represent different curriculum topics, the type of microcomputer hardware or software may be quite different from those purchased initially. This pattern emerged clearly in one school district (Shelby), with the result that the district has most recently felt the need for a centralized, coordinating committee to reassess the purchasing and allocation process, due to complaints about incompatible units and excessive diversity. Excessive diversity of hardware was also found under another decentralized pattern in Cheyenne, to the point that the hardware incompatibility has interfered with district efforts to provide system-wide inservice training.

A secondary sense in which centralization/decentralization is important is in the physical location of the microcomputer units, and not just their organizational supervision. Physically, a centralized pattern would have a large number of units located in the same room, typically a computer lab or a media center (e.g., Linden). This room can then be scheduled for use by different classes, or it can be made available on a shared basis to individual students who are sent to the room by their teachers. A decentralized pattern would have one or a few microcomputer units located in individual classrooms, under the direct control of the classroom teacher. One variant of this pattern is to have the microcomputers on mobile carts (e.g., Prescott and Commack), which are rotated to different classrooms on different school days.

The different physical layouts have organizational implications regarding the centralized or decentralized control over the microcomputers within a school building. Among the cases, no single pattern prevailed; moreover, the same district or building often encouraged the development of multiple patterns, where sufficient numbers of microcomputer units were available. Thus, the resource rooms for special education were a typical place where microcomputers were located, but this did not preclude additional units from being located in other individual classrooms or in a media center.

Overall, in neither the organizational or physical sense, was there a consistent pattern of centralization or decentralization. Whether a district follows one pattern or the other may in part be determined by the degree to which the school district has been centralized or decentralized traditionally. If the district has been traditionally decentralized, the adoption and implementation of the microcomputer system will follow the same pattern, and if deviations are attempted, conflicts may arise. In Cheyenne, for instance, the microcomputers have become a potential source of struggle. The school buildings have taken the major initiatives in adopting and implementing various microcomputer units but the district has attempted to impose a certain degree of coordination and control to assure more effective utilization. Under such circumstances, the accession and implementation process may later be slowed down, as with the moratorium on new purchases that was declared in Cheyenne in the spring of 1982.

Does the Pattern Make a Difference?

The cases have clearly followed different patterns, with neither centralization nor decentralization dominant. Furthermore, neither pattern appears to have clear advantages or disadvantages under all circumstances. What this begins to suggest is that the centralized and decentralized dimension, per se, may not be as important to the growth and utilization of the microcomputers as other factors.

For instance, regardless of the organizational pattern,

- Persons with key characteristics seem to be present as microcomputer use becomes more widespread within a district: teaching experience and control over administrative resources.

The first characteristic appears to be some recent or current teaching experience. The handful of persons beginning to serve as microcomputer "coordinators," for instance, include staff persons who have either been teaching within the recent past or are still teaching part-time, even if their formal positions are now located at the district level. The teaching skill appears to be invaluable in assuring the appropriate integration of microcomputer use within the classroom and daily lesson plans.

The second characteristic appears to be some control over administrative resources. Whether this person is a Superintendent, an assistant superintendent, or even a building principal, the skill is needed to support strongly the initial adoption decisions and to rearrange the necessary administrative procedures as implementation proceeds, including the revision of schedules, the provision of time for inservice training, and even the reallocation of physical space. In one case (Commack), for instance, an elementary school principal had to move walls to make room for a small computer lab.

Together, persons with the two skills may work as a formal or informal group, and the group may or may not be at the district level. The person(s) with the teaching skill helps to identify relevant training and technical assistance procedures as well as the acquisition or development of appropriate software. The person(s) with the control over administrative resources assures that sustained resources are made available for subsequent purchases of microcomputers or software. This tandem combination can operate within both centralized and decentralized patterns and was found in a large proportion of the cases (Lexington, Hopkins, Prescott, Pittsburg, Commack, and Oakhurst).

Microcomputers and Mainframe or Mini-Computers

Related to centralization and decentralization is a second issue that received only peripheral attention in the case studies. This issue followed the notion that, among computer technologies, microcomputers represent an inherently decentralized technology in comparison to the traditional mainframe or even minicomputer. Thus, each microcomputer unit has "stand-alone" capabilities and can be used and relocated in direct relation to a user's needs. Mainframe or minicomputers, in contrast, are centrally controlled and scheduled, but offer a much larger computing capability. The issue was whether any clear patterns of coordination or conflict were emerging among these systems in any of our cases.

In fact, some functional distinctions were emerging, but

only with a typically trial-and-error pattern. Minor administrative tasks that can be done on microcomputers--e.g., the establishment of a class list of students or of a mailing list of parents--were found in several of the districts (see Section V of this report for a full description) where such functions might have been done by the mainframe or minicomputer in the past. With the microcomputers, these tasks appeared to be more satisfactorily conducted, in relation to the user's needs. Similarly, certain kinds of instructional applications that had been done on on-line terminals with a mainframe (e.g., Commack) were now more readily performed on microcomputers, and at lower cost. At the same time, large-scale data reporting or analysis (e.g., payroll, student records, student reporting) were functions generally perceived as more appropriate for larger computer systems.

To this extent, the different computer technologies may all have different niches in the range of functions found in a moderately sized school district. Under such circumstances, it may even be better to have different computer systems for different functions, as such separation increases the security of all of the systems, and also gives each function its rightful priority. A system totally dedicated to payroll, district personnel, and student grades, for instance, would be more secure if no other functions were integrated into the same system, and at the same time would not interfere with the conduct of the other functions (which would have their own computer systems).

Organizationally, the evolution of these different functional patterns are likely to proceed with some care and deliberation. How the coordination and leadership is exercised will vary from district to district, but it is unlikely that either the microcomputer systems or the mainframe (or minicomputer) systems will entirely dominate the whole range of district functions. This realization has emerged, in part, in one case (Prescott) where the supervisor of the mainframe computer has gladly encouraged the transfer of certain functions to the microcomputers.

In spite of this potential long-term complementarity of different computer systems, conflicts did arise in two cases as the microcomputer systems were adopted and expanded. In Oakhurst, the director of data processing voiced some concern over planned administrative use of microcomputers. He believed that such applications would produce inefficiencies and redundancies with the existing mainframe service offered by his department. In Lexington, the data processing department largely ignored the initial adoption and growth of the microcomputer system, and is only now beginning to understand that the commitment of resources to the microcomputers may be a

threat to the minicomputer system in the future.

Conclusion

Both the centralized (top-down) and decentralized (bottom-up) patterns of supervision of microcomputers were found in the case studies. More important than the issue of the relative merits of these approaches was the finding that the microcomputer systems being used successfully tended to depend on support from two different levels--someone acquainted with teaching concerns and another person who could provide the needed administrative support. This team of skills was invaluable during the implementation of the new microcomputers, including arrangements for training, decisions and monitoring regarding the actual location of the microcomputers, and general review of software acquisition.

The role of this implementing team is not to be confused with that of the adopting team. One proposition for future study is that, whereas the decision to purchase new microcomputers may be best put in the hands of a larger committee (representing different interests) or in the hands of a teacher-dominated project team (representing the project directors for a project-specific award), larger-scale implementation requires the mix of teaching and administrative support noted above, but within a small group of two to three persons. In other words, larger committees may not be efficient mechanisms for dealing with implementation issues, and teacher-dominated project teams may not have the administrative support needed to expand microcomputer use beyond the initial project.

V. ADMINISTRATIVE AND INSTRUCTIONAL APPLICATIONS: COMPETITIVE OR COMPLEMENTARY?

Introduction

As more microcomputers are used in school districts, the number of instructional and administrative applications increase. The balance of resources between these two types of applications can affect the growth and stability of the entire microcomputer system. Therefore, an important issue examined by the case studies was the integration of instructional and administrative applications within the same microcomputer system.

School districts have generally considered instructional applications to be more important than administrative ones. However, a common debate is whether administrative applications tend to complement or compete with the instructional uses. Some people view administrative uses as eventually dominating a computer system and displacing the instructional applications. Others feel that the addition of administrative applications can lead to greater district support of a computer system, with the eventual allocation of more resources to both types of uses.

Whether this debate is applicable to microcomputer systems, as well, was one topic investigated by the case studies. The cases were deliberately selected to represent some districts with administrative applications only, with instructional applications only, or with both types of uses. The goal was to compare these types over time--i.e., to see whether there was any evidence that the administrative applications were displacing instructional ones, or whether they were producing increased support for the entire microcomputer system.

Defining Instructional and Administrative Applications

The case study protocol called for determining the degree to which the microcomputers were initially adopted for instructional or administrative use. In documenting the adoption of microcomputers in a school district, the case study focused on the initial purpose and justification for the use of microcomputers. Therefore, the initial design of the system was traced to determine whether there was a favoring of either instructional or administrative uses, with regard to the following priorities:

- the physical location of the microcomputers;
- accessibility of the units to administrative staff and teaching staff;
- the allocation of hardware resources;
- scheduling of microcomputer time; and
- the acquisition of software.

Also, in conducting the case studies, the major applications in each school district were identified and enumerated as being either instructional or administrative. The following criteria served as the basis for categorizing each application:

- the subject matter;
- the dominant type of users;
- the proportion of microcomputer hours used; and
- the name and type of software.

Typical examples of instructional applications in the school districts were: computer literacy, computer programming, and computer-assisted instruction (including drill-and-practice exercises), simulations, problem-solving, and skill games. In addition, the use of microcomputers for word processing to develop students' written skills was found in several school districts.

The most frequently found administrative applications were at the school building level and included student scheduling, grade reporting, attendance reporting, test score data, and student information records. Microcomputers also performed administrative functions at the district level, such as payroll preparation, accounting, data collection, student records, personnel files, and production of education reports. The major applications in each school district are displayed in Table V-1.

Based on the priorities and the types of microcomputer applications, the microcomputers were categorized as being for instructional applications only, for administrative applications only, or for both. In nine of the twelve cases, microcomputers were initially used for instructional activities only. In one

Table V-1
MICROCOMPUTER APPLICATIONS
(Applications and Grade Level of System Studied)

●Abingdon School District

Math instruction, drill and practice
 (h.s. special ed.)
 Computer Literacy program (7th grade
 gifted/talented)
 Programming course (h.s.)

●Hopkins School District

Library inventory and check-out
 system (elem.)
 Basic skills, drill and practice
 reading comprehension (elem.)
 Special education student records
 and tracking (elem. & h.s.)
 Advanced programming (h.s.)
 Financial planning
 Basic skills instruction with CMI
 (elem. special ed.)
 LOGO and Turtle programming
 (elem. & jr. high)

●Pittsburg School District

Attendance records (h.s. principal)
 Student data record files (h.s.
 guidance director)
 Equipment inventory (h.s. vocational
 director)
 Basic skills instruction (h.s.
 special ed.)
 Computer literacy/programming
 (h.s.)

●Boise School District

BASIC programming (elem. gifted/
 talented)
 Basic skills instructional programs
 (elem. special ed.)
 Computer literacy (elem. gifted/
 talented)
 Inventory in food services training
 program (h.s. special ed.)
 Basic skills, drill and practice,
 and games (jr. high special ed.)
 School transportation (Bus) scheduling

●Lexington Regional District

Financial planning and budgets
 (superintendent)
 Student test records (h.s. teachers)
 Tutorial instruction in chemistry,
 biology, and physics (h.s.)
 Design and drafting of blueprints
 in building trades department (h.s.)
 Basic skill instruction (h.s.
 special ed.)

●Prescott School District

Beginning and advanced program-
 ming courses (h.s.)
 Computer literacy (4th-7th grades)
 Basic skills instruction (elem.
 special ed.)
 Student records and placement
 files (h.s. teacher)
 Individual Educational Vocational
 Plans (h.s. teacher)

●Chevenne School District

Basic skills, drill and practice,
 and reading comprehension (elem.)
 Student records (jr. high principal)
 BASIC programming (jr. high)
 Word processing for school newspaper
 and compositions (h.s.)
 Basic skills instruction (h.s.
 special ed.)

●Linden School District

Basic skills, drill and practice
 (elem. & jr. high special ed.)

●Shelby School District

Staff information and evaluation
 files (elem. principal)
 Student grades (elem. teacher)
 Self-directed programming course
 (6th grade)
 Introductory programming, using
 high-resolution graphics (jr.
 high gifted/talented)
 Basic skills, drill and practice
 program with CMI (elem.
 special ed.)

●Commack School District

Basic skills, instruction and multi-
 sensory, interactive games
 (elem. special ed.)
 Word processing and graphics (jr.
 high special ed.)
 BASIC programming (elem. gifted
 handicapped)
 LOGO and Turtle programming (first
 grade)
 Student records, inventories, budgets
 and personnel records

●Oakhurst School District

Basic skills instruction, drill and
 practice, and games (h.s. teacher)
 Introductory programming and computer
 literacy (elem. & jr. high gifted/
 talented)
 Advanced programming (h.s.)
 Tutorial instruction in Spanish and
 French (h.s.)
 Student records

●Tallulah School District

Special ed. forms and manuals
 Records of Individual Education
 Plan (I.E.P.) conferences
 Communications and mailings to
 parents
 Comprehensive, special ed.
 student tracking system:
 student data record files
 District inventory of materials
 and supplies
 Accounting, budgeting

of the cases adoption was for administrative applications only, and in two districts the microcomputers were for mixed (both instructional and administrative) applications. Table V-2 presents the distribution of the twelve cases.

Initial Patterns of Use

In school districts that began with microcomputers dedicated only to instructional applications, the earliest users were typically teachers or staff persons. These persons usually became interested in the instructional potential of microcomputers and had acquired a unit for their classrooms (e.g., Abingdon, Boise, Cheyenne, Linden, Prescott, Shelby). This initial interest in the educational uses of microcomputers then set the pattern and direction for other teachers to acquire microcomputers for instructional use. Only later in the process did the district administration become involved in the implementation of the microcomputers, based on the teachers' growing interests, requests for equipment, and needs for technical assistance and training.

In other cases (Lexington, Oakhurst), the initial interest in adopting the new technology was generated at the district level, but the emphasis still was on acquiring microcomputers for instructional use. The districts would either secure funding and resources for acquiring the units and software to meet individual teachers' requests (e.g., Boise, Cheyenne, Shelby), or make bulk purchases of units and distribute them to schools or individual teachers (e.g., Prescott, Commack, Oakhurst). In one district (Lexington) microcomputers were allocated to teachers only after they had demonstrated potential uses. In another site (Oakhurst), teachers received microcomputers only after completing a training course on computer operations.

In the school district with microcomputers for administrative purposes only (Tallulah), the initial adopter, a district-level administrator, was interested in the business capabilities of the microcomputer and secured the funding and approval for a unit in his office.

In the planned mixed systems (Pittsburg, Hopkins), the initial adopter or planning group investigated the administrative as well as the instructional benefits of the microcomputers. Consequently, both sets of applications were taken into consideration when making the first purchase and allocation decisions. In both districts, the first microcomputers purchased were allocated specifically to either instructional or administrative use, and resources for software were allocated to support both types of applications.

Table V-2
Microcomputer Systems: Patterns of Use

<u>Districts</u>	<u>Applications: Initial Adoption of System</u>	<u>Applications: Present System</u>
Abingdon	Instructional	Instructional
Boise	Instructional	Mixed
Cheyenne	Instructional	Mixed
Commack	Instructional	Mixed
Hopkins	Mixed	Mixed
Lexington	Instructional	Mixed
Linden	Instructional	Instructional
Oakhurst	Instructional	Mixed
Pittsburg	Mixed	Mixed
Prescott	Instructional	Mixed
Shelby	Instructional	Mixed
Tallulah	Administrative	Administrative

How Did Patterns of Use Change?

These initial patterns of use changed over time and are summarized in Table V-2. Of the nine school districts with microcomputer systems initially devoted to instructional uses only, seven later expanded to include administrative applications. Thus, as the microcomputer system grew to meet different needs and more users, administrative uses were also added. Of these six, the administrative uses gradually evolved at the school building level among teachers and principals. Usually, the administrative use has been limited to grade reports, scheduling, attendance, test scoring, equipment inventories, and curriculum development.

In two districts (Cheyenne, Prescott), administrative applications emerged together with the creation of new district-level positions--i.e., microcomputer coordinator or specialist. Persons in these positions acquired units as part of their services and supported other users by reviewing and cataloging software, writing new programs and adapting existing ones, maintaining equipment inventories, and purchasing information. In several districts (Lexington, Shelby, Oakhurst, Cheyenne, and Prescott), one or more microcomputers were allocated to a district-level or principal's office to be used exclusively for administrative purposes. For example, in Lexington, the Superintendent acquired a microcomputer for his office, which he has used for budget projections and reports.

The two districts that began with both administrative and instructional applications (Hopkins, Pittsburg) continued to grow and expand, with the addition of more units and software programs for both types of uses. In Pittsburg, the allocation of resources has assured the growth of administrative and instructional applications at approximately the same rate. To secure the continued development of both instructional and administrative use in Hopkins, two positions have been created--one to concentrate on instructional applications and the other to assist the implementation of administrative ones.

However, in two districts originally having instructional-only microcomputer systems, little expansion of the original microcomputer system has occurred. In these districts (Abingdon, Linden), the microcomputer system has been restricted to instructional applications either through local interpretation of federal project guidelines or by district limitations. Both Abingdon and Linden secured microcomputers through federal projects. The grant proposals specified the exact allocation of hardware, types of applications, and dominant users of the microcomputers. In both cases, the microcomputer system has not

expanded beyond the original project guidelines in terms of applications or additional units.

Similarly, in the district with administrative applications only (Tallulah), the microcomputer system has not added instructional applications, as the system has not grown beyond its original two units and one user for administrative purposes.

It is interesting to note then, that:

- the instructional-only and administrative-only microcomputer systems that have not changed over time to become mixed systems are also those that have not grown or expanded in terms of either the number of units or additional applications.

This observation can be explained by the fact that microcomputer systems have not expanded either their base of users (to cover staff turnover) or their tasks of applications (to extend beyond a single project). Consequently, the microcomputer systems do not have the same growth potential and may be more vulnerable than systems having both types of applications.

For example, in Abingdon the future direction and use of the microcomputer system for special education students is uncertain, due to the scheduled termination of the federal project. With the project director's position ending, no one has been delegated the responsibility of managing the microcomputer system or determining its use. Similarly, the administrative-only microcomputer system in Tallulah is especially vulnerable to staff turnover, because the knowledge of computer operations and the software programs is limited to a single individual. In fact, one district with administrative-only applications was eliminated from our original case study sites because the microcomputer system had fallen into disuse upon the departure of the primary adopter and user, just before selecting sites for the case study.

The Coordination of Instructional/Administrative Use

To the extent that both instructional and administrative applications exist in the same microcomputer system, it is important to determine whether the districts developed any coordinating procedures or strategies. Thus, the case studies documented any evidence of such procedures as those for:

- resource allocation between uses;
- allocation of microcomputer units;
- scheduling of time on microcomputers
- identifying specific users.

Among the districts, those with currently mixed (instructional and administrative) microcomputer use followed different strategies to coordinate the applications. Two school districts (Commack, Oakhurst), starting out with microcomputers for instructional uses, decided to purchase separate microcomputer units for the administrative applications. In Commack, a deliberate decision was made to purchase different hardware, to avoid any conflict between the two types of uses. A different example is Tallulah, where the microcomputer system studied has remained exclusively administrative, but the district has adopted an entirely separate system (different hardware brands) for instructional purposes. The installation of separate systems for administrative and instructional uses precludes any sharing of the microcomputers, which in turn avoids conflicts between the different applications.

In other school districts, the same microcomputers are used for both administrative and instructional applications, with coordination between the two evolving informally among the users. Several districts (Prescott, Lexington, Cheyenne) have enough microcomputer units and other resources so that the use of some units for administration does not hamper or curtail the instructional use. Resources such as software, equipment, and training are allocated to the teachers and staff persons to support both instructional and administrative interests in the microcomputers.

Conflict between the two types of uses has been avoided in some districts by having teachers and staff persons schedule any administrative use during times when there is not student use. In one district (Pittsburg), a teacher had the students involved in his administrative applications by having them enter data, update files, and adapt business software, as practical learning experience on the computer.

Conclusion

None of the twelve cases offers any evidence to suggest that there is a conflict between administrative and instructional applications in microcomputer systems. Furthermore, there is a possibility that the two types of applications are complementary, as neither instructional-only nor administrative-only systems have grown and expanded as readily as mixed systems.

Districts with mixed systems have developed different coordination strategies and procedures to manage both types of applications, in order to reduce the possibility of competition or conflict. Some districts have chosen to allocate separate units to the two types of uses; other districts have used the same microcomputers for both administrative and instructional applications. Both coordination strategies have resulted in similar growth and stability of the microcomputer systems.

Furthermore, microcomputer units used for both administrative and instructional applications are not at this time dominated by the administrative ones or displacing any instructional use. In part, this can be explained by the fact that administrative use tends to grow gradually and is limited to only a few users. Consequently, it is not likely that a district's demands for administrative microcomputer use will race ahead of the number of units. Also, a single microcomputer and several software packages can serve many administrative needs.

When administrative use does reach the level where there may be competition with instructional applications, then additional units can be designated. This flexibility may be different from earlier experiences with computer systems in schools, in which the number of on-line terminals or the amount of computing time was limited. With microcomputer systems, additional units can be added, as the system as a whole can grow in an incremental fashion.

VI. TRAINING AND EMERGING STAFF ROLES FOR MICROCOMPUTER IMPLEMENTATION

Training

The literature on the implementation of microcomputers in school systems stresses the importance of training for teachers and other staff if they are to be able to use microcomputers effectively (Coburn et al., 1982, Taber, 1983). Teachers must know how to operate the microcomputer, how to select, evaluate and run software, and how to manage the microcomputer. This is necessary to effectively integrate the technology into the classroom. Thus, it may be argued that training is essential not only for successful implementation but also for subsequent growth of the microcomputer system to occur.

For the purposes of this study, training was defined as organized, inservice, group instruction. This could have included a multiplier approach, in which the individuals trained were required to train others. However, totally individual instruction, such as one-to-one technical assistance, was not considered training.

Examples of Training The case studies documented the training activities for planners and users of the microcomputer systems in 12 school districts. Table VI-1 shows the training provided in each district. Six districts (Cheyenne, Commack, Hopkins, Lexington, Oakhurst, and Prescott) were all considered to have offered major resources for training. The other six districts had the following experiences.

In two cases (Boise and Pittsburg), the microcomputer systems were considered to be in a transition stage. In Pittsburg, the users of the existing 14 microcomputers were self taught or had received individualized technical assistance from the system coordinator. The district was beginning to implement formal training in anticipation of additional microcomputer purchases. Training was being offered to teachers who as yet had no computers and, in effect, was being conducted during a "pre-implementation" stage. Similarly, four of the 13 microcomputers in Boise were purchased within the last year, and applications on these were just being implemented. The primary resource in Boise was individual technical assistance, although a training program had been initiated for teachers in the gifted/talented program.

In a third case, Tallulah, only the administrative microcomputer system was studied. The major operator of the system was self-taught. In the remaining three districts

Table VI-1

Inservice Training for Microcomputer Implementation:
Districts with Major Inservice Resources

District	Format	Content Areas Covered
Cheyenne	District Workshops TRS-80 and Apple Users Groups Building Level Inservice Evening Courses (sponsored by student group)	Introduction to Computer Operations BASIC Programming Software Adaptations Computer Literacy Word Processing
Commack	District Inservice Course Open to All Staff District Inservice for Administra- tors Building Level Inservice	Computer Awareness and Operations BASIC Programming Integration of Computers into the Classroom Advanced BASIC Programming Word Processing Computer Graphics
Hopkins	District Inservice Building Level Inservice	Beginning BASIC Intermediate BASIC Computers in the Classroom Use of Computers for "Cooperative Learning" Advanced Programming
Lexington	District (one building) In- service	Microcomputer Operation Evaluation/Selection of Software Lesson Development Instructional Applications Administrative Applications Computer Awareness Programming
Oakhurst	District Inservice for All Staff District Inservice for Special Education	Introduction/Orientation to the Microcomputers Evaluating Commercial Software BASIC Programming Advanced Programming
Prescott	District Inservice	Introduction to Computers Computer Literacy Computer Programming

Table VI-1

Inservice Training for Microcomputer Implementation:
 District with Minimal Inservice Resources

District	Format	Content Areas Covered
Abingdon	Group Training for Title IV Project Participants (Spec. Ed.) only	Basic Introduction to Computer Running Project Software and BASIC Programs
Boise	District Inservice for Gifted/Talen- ted Teachers Building Level Inservice for Special Education	Using Computer as Instruc- tional Tool Computer Literacy
Linden	Group Training for Title IV Project Participants (Spec. Ed.) only	Use of Project Software Computer Literacy
Pittsburg	District Inservice	Introduction to Micro- computers
Shelby	District Inservice for Project Participants Building Level Inservice	Computer Literacy
Tallulah	(None - Administra- tive System only)	

(Abingdon, Linden, Shelby), minimal training had been provided. In Abingdon and in Linden, the training content was limited to Title IV-C project objectives and was offered to project participants only.

When Does Training Make a Difference? It was anticipated that the level of training available would be associated with the growth of the microcomputer system. The case studies examined the validity of this assumption. Growth was defined as a rate of increase in the number of microcomputers in the system, together with the increase of users, expansion of applications, and diversification and efficiency of microcomputer use.

The patterns for growth in numbers of microcomputers for each district are summarized in Table VI-2. In three of the districts (Abingdon, Linden, and Shelby) the initial purchase of microcomputers was for pilot special education projects. The federal project in Abingdon was expanded to include an additional computer lab in a second school, resulting in an increase in the number of computers and users. Although the project did not expressly limit the applications to those originally intended, there was no expansion of applications beyond those for which the teachers had been trained. Shelby was an example of a system where growth in the number of microcomputers had outstripped the training opportunities. Some teachers received computers because federal funding was available even though they did not request them. Some teachers with microcomputers reported that they did not know how to operate them. A moratorium was placed on additional microcomputer purchases and a committee was established to assess the microcomputer curriculum.

For the remaining districts (Cheyenne, Commack, Hopkins, Lexington, Oakhurst, Prescott), two clear patterns emerged. First, all demonstrated steadily or rapidly growing microcomputer systems and also offered major resources for training teachers and administrators during the implementation stage. A combination of group training opportunities were made available, as well as the assistance of district or building level microcomputer experts or computer coordinators for additional help and information. Major training opportunities included district organized inservice training on a variety of topics and levels, offered on a continuous basis (e.g., Hopkins, Commack, Prescott). In addition, user orientation, building inservice, parent inservice, classes by local universities, school clubs and user groups, and individual technical assistance by a computer coordinator/expert were also available.

The second pattern that emerged was different from prior expectations regarding growth and training. It had been

Table VI- 2

GROWTH PATTERNS FOR MICROCOMPUTER SYSTEMS

Districts with Major Resources for Training	Total Number of Microcomputers in System	
	<u>By 1979</u>	<u>By 1983</u>
Cheyenne	4	130
Commack	10	46
Hopkins	1	123
Lexington	2	22
Oakhurst	14	40
Prescott		298
Districts in Transition		
Boise	4	12
Pittsburg	4	14
Districts with Few Resources for Training		
Abingdon	4	23
Linden	3	15
Shelby	5	18
Tallulah	1	2

anticipated that where training had been planned and offered during the start-up or pre-implementation phase, smoother and more rapid growth would take place. However, analysis of the case studies disclosed that group training was not a critical factor during the start-up phase. Rather, this phase was characterized by individual technical assistance, orientation, and exploration. This form of instruction appeared to satisfy user needs for the first few microcomputers in the system. However, individual technical assistance limits the growth of the system. The technical assistant can only train one or two individuals at a time, thereby taking longer to reach all the users within the system. When the system expands beyond six to ten microcomputers, the training needs of the increased number of users require formal training to be established.

Three districts (Oakhurst, Lexington, and Hopkins) did offer inservice training to users during the start-up phase. In these cases the training appeared to be extremely useful in establishing interest in and awareness of the microcomputer system. In fact, in one district (Oakhurst) a policy decision was made in the planning stages that microcomputers would not be distributed to the teachers until they had undergone enough training to enable them to use the microcomputers properly. In another site (Lexington), teachers were required to develop a plan demonstrating how they would use the computers in their classroom as justification for receiving one.

The case studies also investigated the effect of the quality of training on the use of the microcomputer. "Quality" training was perceived by users to mean relevancy of training topics, and compatibility between the equipment used in training and the equipment accessible to users. District training which emphasized basic orientation to microcomputers and direct applications in the classroom seemed most popular and was often oversubscribed.

In contrast, initial training efforts were less successful when the objective was to teach participants how to program (Cheyenne, Oakhurst). The introductory courses were subsequently changed to cover issues of more immediate relevance: microcomputer use and operations (loading and running programs), integrating computers with the curriculum, authoring systems, word processing, and evaluating software. Some districts (Hopkins, Cheyenne) did offer advanced level programming courses which were well attended. However, these courses were part of a continuum of beginning and intermediate level inservice training that had been offered in previous years. As users demonstrated more technological sophistication, the need for advanced level courses including programming and languages evolved.

The history of microcomputer implementation in Cheyenne

illustrated the need for "quality" training. Cheyenne had 130 microcomputers, which included five different brands, and various models of each. The district's initial efforts at training focused on programming skills. These efforts were hindered because the training equipment did not match equipment available to users within each building. At that time, programming courses were too advanced for teachers' experience and interest, and were undersubscribed. Subsequently, two of the initial users of microcomputers in the district began a series of Saturday morning workshops for a basic introduction to microcomputers, oriented towards TRS-80 or Apple users. The district now sponsors workshops which include an introduction to computer operations, BASIC programming, and methods for adapting software to meet user needs. Advanced level programming is now available with high school students as instructors.

The pattern for training during the successful implementation of microcomputers in a school district appeared to follow a distinct sequence. The adoption of the first few microcomputers was usually initiated by computer enthusiasts, often self-trained or intrinsically self-motivated enough to seek training on their own. As new users became involved, the initial adopters were able to provide technical assistance to them. The informal tutoring and sharing of information created the setting for others to become interested, but at the same time did not compound any fear or resistance to change that some teachers may have had.

As the new users increased, however, this expansion created a demand for more formal training beyond the reach of a single adopter. At this stage more formal training was required, and needed to cover a basic introduction to microcomputers as well as information on how to integrate them into the classroom.

Separate Training for Special Education Teachers. Across the case studies, the content of training and course objectives appeared to be equally relevant and applicable for both regular and special education. In other words, techniques and knowledge required to use the microcomputers did not differ between regular and special education users. (The software used by special educators was developed for students in general; specific software geared to special education needs was not readily available.)

Emerging Staff Roles

The growth of the microcomputer system in a school district creates a need for managing the system. When implementation occurs in a decentralized manner, decisions regarding implementation tend to occur in isolation. As elements of the system becomes centralized, decisionmaking can be coordinated across the district. This can reduce redundancies and inefficiencies in the system.

Coordinator Role. The case studies documented the coordination patterns for the districts' microcomputer systems. Persons involved in the implementation support process were identified, and coordination activities traced, to determine the extent to which new organizational roles were created for managing the system. A person (or group) was considered to be the "coordinator" as a function of participation in:

- the purchase and allocation of the micro-computers;
- the review, purchase and allocation of software;
- maintenance of a central file/catalogue of software;
- the scheduling and planning of computer use; and
- provision of training and technical assistance for users.

In some cases, evidence for this role was determined by a district formalizing the role with a position statement/title. A coordinator role could also be filled in an informal manner; an enthusiast/expert assumed these responsibilities. Whether the district recognizes or establishes an official coordinator's role is in part determined by its overall centralized or decentralized pattern for supervision, and also by its support for microcomputer implementation.

Table VI-3 shows the status of coordinator roles across districts. It can be seen that this role did emerge in some form in each district, whether or not it was supported or formalized on a district level. Whether these activities were conducted by a single individual or a planning group varied across sites, but responsibilities were similar. It appears that, like training:

Table VI- 3
PLANNING GROUPS AND COORDINATOR ROLES

District	Pre-Implementation Stage		Implementation Stage		Formal Coordinator Role	Informal Coordinator Role
	Formal Group	Informal Group	Formal Group	Informal Group		
Abingdon [*]		X	X		X	
Boise	None	None		X		X
Cheyenne	None	None	X		X	
Commack		X		X	X	
Hopkins	X		X		X	
Lexington	X			X	X	
Linden [*]		X		X	X	
Oakhurst		X		X	X	
Pittsburg		X		X		X
Prescott	X			X	X	
Shelby		X	X			
Tallulah ^{**}						X

*Abingdon and Linden established role for duration of project only

**Tallulah coordinator is primary user

- when growth occurs beyond the initial adoption of the first microcomputers, the need for coordination of the microcomputer system evolves and the role of a formalized or informal coordinator emerges.

Two districts (Abingdon and Linden) established a coordinator role for the duration of their federal projects. The coordinator's activities did not extend beyond the computers allocated for the project and were terminated when the projects ended. The coordinators were primarily responsible for carrying out the tasks stipulated within the project guidelines, which directed how the microcomputers were to be used. Those districts demonstrating the most rapid and extensive growth also had established at least one formal (full or part-time) coordinator role (Lexington, Hopkins, Prescott, Oakhurst, Commack, and Cheyenne). In Lexington there were two staff members performing these duties. After the first 12 microcomputers were purchased, the Superintendent created the position of microcomputer master teacher. The designated individual was previously a special education resource teacher in the developmental math lab. The new role required him to divide his responsibilities between instructing special education students and coordinating the microcomputers. He became responsible for providing inservice training, maintaining the equipment, and serving as a resource to staff. In addition, the staff person in the media center/library became the "microcomputer specialist" for the units in the microcomputer center. The specialist's responsibilities included: scheduling and managing the use of the center's computers and maintaining the district's software library.

In Hopkins, a combination of supervisory patterns for managing the 120 microcomputers emerged. Centralized coordination occurred at the district level, and decentralized coordination/autonomy occurred at the building level. At the district level, the following activities were coordinated: the development of instructional and administrative applications, software, and training sessions; maintenance and use of computers; and coordination and compilation of software. Individual purchases of equipment were made at the building level. The media specialists in each school were responsible for implementation of the system including acquisition and maintenance of the equipment. They also received support from the district level coordinators.

The pattern for the emergence of coordinators appeared to parallel trends in training. That is, the same person or group

that had initiated or adopted the first microcomputers in the district became the most likely candidates to fill the coordinator's role. Having served as a resource to users during adoption, the initial "adopter" continued to be approached by district personnel and teachers for technical assistance. In Commack, for example, the special education teacher who had been instrumental in implementing the district's first pilot microcomputer project, took on a newly created part-time role as the district's computer curriculum specialist. She also continued to teach in a resource room at one of the elementary schools. Under guidance from the director of student services, her responsibilities included developing educational computer programs, designing staff development activities, coordinating allocation and use of equipment, and preparing budgets and purchase orders for the director. She also developed and implemented pilot demonstrations in classrooms for new sets of applications.

In districts without an officially designated coordinator, a technical resource person still emerged. In Boise, the implementation process was highly decentralized. Purchases of microcomputers and their applications were implemented independently within schools by individual teachers, and allocated to those who had requested the computers. The first microcomputer was acquired by one of the special education consulting teachers and, subsequently, he informally became the coordinator for the special education microcomputers. He added this responsibility to his concurrent role of technical assistance provider for special education teachers; he considered microcomputer assistance part of his support role. He offered suggestions on using the equipment, transported computers between buildings, and trained teachers for new applications. He advised teachers on the suitability of particular software, and shared software as needs arose.

Does A Coordinator Make a Difference? The lack of some type of coordination for the microcomputers leads to problems that may impede growth and effective use. Without the monitoring, direction, or guidance from someone serving in this capacity, users will operate independently of each other. The lack of communication may result in isolated purchases, which do not benefit from the shared experience of others. People unaware of applications within their building or across the district duplicate purchases and costs. The increasing diversity of types of computers purchased creates incompatibility of software, and limits shared, more efficient use of the computers. The coordinator can facilitate continuity within the school district and conserve dollars, time, and effort.

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INDIVIDUAL CASE STUDY REPORTS

WASHINGTON COUNTY SCHOOL DISTRICT
Abingdon, Virginia

Case Study Report

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I. SUMMARY NARRATIVE AND CHRONOLOGY

The School District

Washington County contains 571 square miles of farmland, woodlands and mountainside, and lies 40 miles east of Kingsport, Tennessee, and 130 miles West of Roanoke in southwest Virginia. Agriculture is the major industry, but Washington County is also campaigning to attract small business to the area. The 1981 population is listed at 46,487, which marks an increase of 5,652 people since 1970. Three colleges are located in the vicinity of Abingdon, Virginia, the site for this case study.

There are 17 schools in Washington County: 13 elementary and 4 secondary schools. The schools are relatively isolated due to the size of the county and its rural, mountainous characteristics. The current enrollment of approximately 8,800 students, of whom 730 are designated special education students, reflects an ethnic composition of 93 percent white, 7 percent Black, and 2 percent from other racial origins. One or more special education classes are in each of the 17 schools. All schools have one special education class and provide speech therapy. A county-wide curriculum is used for regular education students. A core curriculum for EMR students is used in one high school.

The school district has been experiencing a declining budget in recent years which has resulted in the consolidation of administrative assignments. The Superintendent of Schools, for example, also serves as the director of secondary education. One person is both assistant superintendent and the director of vocational education. Similarly, the director of federal programs is also the coordinator of testing/evaluation. The supervisor of special education is responsible for all administrative and curricular functions related to special education. All teachers, including the 45 special education teachers, are (most directly) responsible to their building principals. Other than building level principals and assistant principals, the only additional administrative staff consist of two supervisors in the areas of reading and math.

The district currently has a total of 46 microcomputers. Half of these (23) were purchased for special education through a Title IV-C federal grant. These microcomputers were the subject of this case study.

Washington County has 23 additional microcomputers for regular education use which were not part of this current investigation. Three of the high schools each have one Apple

II-Plus, 48/64K with disk drives, purchased through ESEA Title IV-B funds. Abingdon High School also has one Franklin ACE 1000 microcomputer purchased with Distributive Education Department funds, and an Apple III purchased with general funds that is used for class scheduling and word processing. John Battle and Holston High Schools each purchased one TRS-80 in the 1981-82 school year through School Club (math and science) funds. Abingdon Elementary's PTA purchased four Texas Instrument-99 microcomputers in November 1982. Twelve Apple II-Plus microcomputers were purchased in November 1982 through Chapter II Funds; four each are located in John Battle and Holston High Schools, and one in each of the four elementary schools.

Overview of Microcomputers Studied

All but one of special education's 23 Apple II-Plus microcomputers are located in computer labs in two high schools (11 units in each lab). The project coordinator for the grant uses the one additional Apple II-Plus for adapting and developing software. These 23 Apples are used for a variety of instructional purposes:

- The special education teachers at both schools use Milliken Math Series software for computer-assisted-instruction with 70 special education students enrolled in math classes. The microcomputers are used more than 50 percent of class time to develop the specific math skills outlined in students' IEPs.
- Approximately 16 regular education students at Patrick Henry High School, in 11-12th grades, participate in a one-semester elective computer programming course.
- The computers are also used after school for an eight-week class in computer literacy where basic computer programming skills are taught to 7th graders. About 70-80 regular education and gifted/talented students participate in this 12-hour course which is coordinated by the supervisor of elementary mathematics.
- Informal exploration and work on individual projects by interested students takes place before school for approximately one hour and in unscheduled periods during the day. These sessions are supervised by the regular education math teachers.

- The University of Virginia Extension Campus uses the Abingdon High School computers to offer three evening programming courses for community residents.

Chronology

The microcomputers purchased for the special education program were the first ones acquired by the Washington County School District. In the fall of 1979, the industrial arts teacher at Patrick Henry High School asked a special education teacher to co-author a proposal for an ESEA Title IV-C Innovative Projects grant. The director of federal programs approved the effort, and the two teachers sought funding.

A three-year grant was awarded in June 1980, which included a pilot year followed by two years of implementation. The primary goal of the project was to determine the effects of microcomputer use on math achievement and school attitude of EMR/LD students at the secondary level. During the fall of 1980, the first microcomputer purchases were made, and software for mathematics instruction was adapted and developed. A computer lab was established at Patrick Henry High School, equipped with 11 Apple II-Plus microcomputers.

Student instruction began in March 1981. In May 1982, a second computer lab was created at Abingdon High School and equipped with an additional 11 Apple II-Plus microcomputers. (The case study occurred in the third and final year of the project.)

The project initially served 20 special education students, but was expanded to include 70. Students were exposed to a developmentally-based, sequentially organized, computerized program designed to teach general mathematical skills, with lesson objectives based on instructional materials in the Milliken Mathematics Series. Each lesson guided the student in performance of a task until the student's responses reached a mastery criterion. Control groups receiving regular special education mathematics instruction were formed at Holston, John Battle, and Abingdon High Schools.

The evaluation plan included in the project proposal stipulated a pre/post test, control group design. Self-evaluation and third party evaluations were also conducted to assess whether project objectives had been accomplished. The findings of the 1981-1982 Third Party Evaluation Report were neutral or positive regarding specific outcomes of the first full year of implementation. The Report concluded, however, that students exposed to microcomputer assisted instruction appeared to experience achievement gains in mathematics during the school year

and that they seemed to have more positive attitudes than similarly handicapped students not exposed to microcomputers.

Supervision for the project was provided by the director of federal programs, assisted by the supervisor of special education and the director of vocational education. These three individuals report directly to the Superintendent. During the implementation of the project an industrial arts teacher (one of the original proposal co-authors) was named project coordinator and maintained responsibility for coordination of the microcomputers. He also received requests for software purchases and forwarded them, through the director of federal programs, to the Superintendent for approval. Use and scheduling of the computers were strictly stipulated in the grant guidelines. In addition, the project coordinator distributed all Title IV-C software to the two participating high schools and provided technical assistance to users. He worked closely with the special education teacher (and proposal co-author) who implemented the project with her students.

These two teachers have worked together throughout the project, while continuing their teaching responsibilities. However, the supporting administrative staff has changed. In September 1981, the director of vocational education assumed the additional duty of assistant superintendent of Washington County Public Schools. As the Title IV-C project administrator, he worked closely with the coordinator of evaluation and research who is the Title IV-C project director. The assistant superintendent recommended budget amendments regarding charges for equipment, salaries, instructional materials, supplies, travel, and inservice. He forwarded these proposed changes to the Superintendent. The amendments were approved by the state director of federal programs, and by the state coordinator of special projects and grants. The ESEA Title IV-C Administrative Manual stipulates that the project director is required to present, at the end of the first year, an itemized budget showing anticipated funds needed for the next year's operation. Subsequent budget amendments were needed to remain within the range of allocated grant monies.

Four additional special education teachers are now participating in the project--three at Abingdon High School and one at Patrick Henry High School. The participating teachers received inservice training on how to incorporate the microcomputers in their math instruction. Lesson objectives were correlated with Milliken Mathematics software and with Mathematics for Individual Achievement, a basal mathematics textbook.

In 1982, Washington County secured additional federal funding for 19 microcomputers that, unlike the Title IV-C microcomputers, were not designated for special education use. The

success of the IV-C project appears to have served as a catalyst for the county's decision to introduce microcomputers into regular education.

The major events in the implementation of microcomputers in Washington County School District are presented in Table 1.

Table 1: Chronology of Implementation

Washington
County
School
District

Date Month-Year	Event
<u>1979-1980 Academic Year</u>	
Nov. 1979	Two teachers discussed the possibilities of microcomputers as instructional tools for EMR/LD students.
Dec. 1979	Submission of Title IV-C proposal requesting 13 microcomputers.
June 1980	Acceptance of proposal with state recommended revision designating the first year as a pilot/planning year. The purchase of two microcomputers was authorized.
Aug. 1980	Purchase of two Apple II-Plus microcomputers with printers.
<u>1980-1981 Academic Year</u>	
Sept.-Feb.	Project planning, development and purchase of software.
Jan. 1981	Participating special education teacher attends computer course.
Feb. 1981	Title IV-C self-evaluation conducted.
Feb. 1981	Evaluation plan drafted by external evaluator.
March 1981	Pilot project with student instruction begins.
March 1981	On-site visit by state evaluation team.

May 1981	Evaluation report submitted.
June 1981	State Title IV-C office approves purchase of three additional Apple II-Plus microcomputers with unspent salary, inservice, and travel funds.
June 1981	Three Apple II-Plus microcomputers purchased.
July 1981	Ten additional microcomputers requested (was approved).

1981-1982 Academic Year

Oct. 1981	Purchase of seven Apple II-Plus microcomputers (Authorized 7/81); computer lab with 11 work stations set up.
May 1982	Evaluation report submitted.
May 1982	State Title IV-C office authorized purchase of five Apple II-Plus microcomputers with unspent funds.
May 1982	Purchase of three Apple II-Plus microcomputers (authorized 7/81) and five Apple II-Plus units (authorized 5/82) to enable expansion to a second site.

1982-1983 Academic Year

Aug. 1982	1-1/2 day inservice training for 30 special education teachers.
Sept. 1982	Computer lab with eight Apple II-Plus computers established at second high school.
Sept. 1982	Six hours of after-school instruction provided for three special education teachers participating at the second site.
Oct. 1982	Four hours of additional instruc-

tion provided for the above three teachers.

Nov. 1982

Three additional Apple II-Plus microcomputers were authorized and purchased; total of 11 microcomputers in each computer lab.

II. FEATURES OF THE MICROCOMPUTER SYSTEM

Introduction

The microcomputers studied in Washington County were 23 Apple II-Plus units, each equipped with a disk drive and a color monitor. The project coordinator uses one Apple II-Plus computer with a Centronics 779 printer in his office. The remaining microcomputers are located in two computer labs (11 units in each) at two high schools, Patrick Henry and Abingdon. One microcomputer in each lab has a dual disk drive. There is a Paper Tiger printer in one lab and an Epson MX-80 printer in the other.

The computer lab at Patrick Henry High School is located in a small room that previously was designated as storage for the physical education department. Access to the lab is possible only by exiting through a rear door of the school and walking a short distance out of doors. Eleven Apple II-Plus microcomputers are arranged at individual work stations, lining three walls of the room, with the last two units filling the space in the center of the room. These units, together with the teacher's desk and a bookshelf for software storage, completely fill the room.

The 11 microcomputers in the lab at Abingdon High School are placed on long tables lining opposite walls of the room. Several tables, arranged end-to-end in the middle of the room, provide a central location for distributing materials. A large metal cabinet is used for storing software. The lab is located on the second floor of the high school in the science and math wing of the building. The large room was previously used as a science fair workroom.

Five special education teachers and 70 special education students use the microcomputers regularly for math instruction. There are several periods each day when the labs are not scheduled for special education math instruction. During one of these open periods at Patrick Henry, a math teacher teaches programming to 16 upper-level regular education math students. During the two unscheduled periods at Abingdon, the lab is open to students with passes who are working on independent programming projects (approximately 25 students participate). Supervision is provided by regular education math teachers. An eight-week computer literacy program for gifted/talented seventh graders is held after school for approximately 70 students. Both labs are used for this program. At the Abingdon computer lab, three evening programming courses are conducted by the University of Virginia Extension Campus.

Management of the Microcomputers

The supervisor of special education is responsible for all administrative and curricular functions related to special education in Washington County. The present supervisor, unlike her predecessor, is not directly involved in decisions regarding the Title IV-C microcomputers. She is informed of project progress, but devotes most of her time and attention to direct supervision of teachers and administration of services for special education students.

Most of the decisions regarding use of the ESEA Title IV-C microcomputers and software purchases are made by the co-authors of the Title IV-C grant. Decisions are communicated to the director of federal programs and the Superintendent for approval. Requests for purchasing additional microcomputers come from the project director and administrator and must be approved by the State Title IV-C program office. Use of the microcomputers must comply with Title IV-C guidelines both during and after the grant period. The principals and assistant principals at the two high schools have been involved in decisions concerning space allocation, scheduling of classes, and security procedures. After-school use of the labs is arranged with the building principal by the using group and with permission from the Superintendent.

During the first year of the project, both teachers maintained their full-time teaching assignments. The project coordinator (the industrial arts teacher) received a salary for an additional 5-8 hours per week devoted to after-school planning and program development activities. During the second and third years, the project coordinator's courseload was reduced by one class. For the last two years, the special education teacher was allocated five hours per week, after school time, for project implementation. This year both teachers share study-hall responsibilities during the same period, allowing them additional time to coordinate project activities.

Illustrative Applications

To provide an idea of how the microcomputers are being used in Abingdon, three illustrative applications are described below.

Computer-Assisted-Instruction--Mathematics. Several teachers commented that microcomputers have enabled them to manage more successfully the on-going individualization of a student's math instruction. In one class, nine students can work at nine

different ability levels ranging from second grade to eighth grade. One teacher reported that microcomputers have eliminated the occasional "dead times" in which one or more students required specific information before they could continue an activity or move on to the next. One teacher noted that the interest shown by the advanced level math students to attend a computer programming class in the special education room has had an unexpected positive effect on the special education students. Several regular education students have asked to be in special education so that they might have access to the microcomputers.

In a class that was observed in the computer lab at Patrick Henry High School, eight special education students arrived and began loading their disks. The teacher made some general announcements and pointed out individual assignments on the blackboard. Students returned to their various (computer assisted) lessons in subtraction, multiplication, and division that they had been working on the previous day. The teacher pointed out that this was ordinarily a time also used for individual conferencing with students. Students in her class spend half of a class period using the microcomputer. The other time is divided among activities such as conferences, pencil and paper math activities, and math games.

Computer Literacy--Gifted/Talented. This is the second year that an after-school computer literacy course has been offered to gifted/talented seventh-graders. The eight-week course is held once a year and is coordinated by the supervisor of elementary mathematics. The Title IV-C project staff and the director of evaluation/testing have served as instructors during both years of the program. This year there are seven instructors and approximately 70 students involved in this 12-hour course. Instructors have met on one occasion to discuss the topics to be covered. A course syllabus is being considered, but in the meantime the instructors, most of whom are elementary math teachers, prepare course lessons independently. The courses are held at Patrick Henry High School and Abingdon High School computer labs. The course develops basic knowledge of what a computer is, how it works, and what it can and cannot do, as well as providing opportunity to acquire basic programming skills.

During an observed class session at Abingdon, all ten students worked individually at their own microcomputers. Their attention to the screen was interrupted only occasionally when they would seek assistance from the teacher, make a brief exchange with a neighbor, or return to the central table to exchange activity cards. The teacher circulated around the room answering questions and expressing her approval of students' work. At 5 p.m. (dismissal time), students had to be reminded several times by the teacher that it was time to pack up and go

home. One student delayed until he had a printout of the program he had been working on. He was planning to finish writing the program on his computer at home.

Computer Programming Instruction--High School. Patrick Henry High School added a computer programming course to its high school curriculum during the school year 1982-83. This course is offered for one semester as an elective to 11th and 12th graders who have completed Algebra II. Classroom enrollment is limited to 16 due to the small size of the computer lab. Two students can work together at no more than five microcomputers. A course outline was developed by the math teacher and approved by the school board. The course is offered during a period when the microcomputers are not being used by the special education classes. There is presently a waiting list of students who would like to enroll in this course.

During observation of the class, students walked in and immediately began to load what appeared to be independent projects they had been working on. After all the students had arrived, the teacher directed them to their textbooks. Following a short presentation on a new concept, students were given a programming assignment. When students finished their assignment, they returned to the independent projects on which they had been working.

III. ORGANIZATIONAL ISSUES

Centralization and Decentralization

Administrative and curricular functions related to special education are monitored by the supervisor of special education, who is directly responsible to the assistant superintendent. The supervisor of special education manages the special education teachers and support staff and monitors responsibilities related to P.L. 94-142 implementation. Most of the decisions regarding the administration of the Title IV-C microcomputers are recommended by the co-authors of the proposal and approved by the project director and assistant superintendent. Budget amendments are accepted by the state director of federal programs, and by the state special projects and grants coordinator.

The initial adoption of the microcomputers was highly centralized. Because all the computers were purchased with Title IV-C funds, it was mandated that high priority use be given to special education students for basic math skills improvement. The evaluation component of the project further defined the specific software to be used and the manner in which the math lessons would be conducted.

The Title IV-C project will end in July 1983, and staff indicated that the centralizing effect of the grant has decreased over time. The supervisor of special education does not plan to implement any procedures next year that would restrict or control use of the Title IV-C computers. The position of project coordinator will also end with the project and the present coordinator does not anticipate being able to give much time to similar activities next year. No administrator or faculty member has been delegated the responsibility for coordinating the use of these microcomputers in the future. Administrators would like a computer coordinator position to be developed, but they don't anticipate that funds will be available for such a position.

In two years, the number of microcomputers in the Washington County School district increased from 0 to 46. Although administrators are interested in centralizing procedures such as software acquisition/distribution, the only centralized action currently underway is the provision for an employee to be trained in equipment maintenance. Use of other microcomputers in the district is decentralized -- directed at classroom or school building levels.

Special and Regular Education Interaction

The original Title IV-C proposal addressed specific collaborative activities between regular and special education teachers. The plan was for special and regular education teachers to team with the Title IV-C project director to carry out IEP math objectives using CAI-math and to coordinate its use with mainstreamed handicapped students in regular education classes, the library, and special education rooms. When the State IV-C office recommended that the project be revised to make the first year a planning/pilot year, the initial purchase of microcomputers was reduced from 13 to 2. The pilot project concentrated on CAI-math instruction in one special education teacher's classroom, and the first year budget for inservice training was significantly reduced. Evaluation of this pilot project indicated that the experimental group (12 EMR students) were not likely candidates for mainstreaming at the secondary level. Therefore, the original emphasis on mainstreaming and subsequent collaboration between special and regular education teachers was reduced. Extensive training of one regular education math teacher and one special education teacher in the first year was not retained. The targeted math teacher did, however, receive training during a school-wide inservice. This math teacher has collaborated with the special education teachers in scheduling use of the computer lab; he is presently teaching a programming course to upper level math students during a class period when the microcomputers are not used by special education students.

Although the Title IV-C microcomputers were initially intended strictly for special education use, informal collaboration for scheduling and shared use with regular education now occurs. The proposal guidelines enforce use for special education students as needed, but allow for the availability of the microcomputers to other students and staff with the approval and clearance by the Title IV-C coordinator and staff.

At Abingdon High School, three special education teachers participating in the Title IV-C project have met with the math and science department chairmen to schedule use of the special education computer lab. These are the only five staff who have keys to the lab (which is located in the math and science wing of the high school). It was decided that during the two class periods per day when there were no special education math classes scheduled, the lab would be open to students with passes and supervised by a math or science teacher. Several special education teachers expressed concern and uncertainty as to whether there will be major changes in how the lab will be scheduled for use next year when the Title IV-C project is over. One regular education teacher mentioned the possibility of one or more programming courses being offered next year. The high school presently owns one Apple II-Plus microcomputer for in-

structional use that has not been purchased with Title IV-C project funds. This microcomputer is wheeled on a cart to classrooms and then returned to the special education computer lab.

Administrative and Instructional Applications

There are no administrative applications of the Title IV-C microcomputers at the Abingdon High School lab. The principal of Abingdon High School recently purchased a separate Apple III microcomputer to be used for administrative purposes -- class scheduling and word processing. At Patrick Henry High School, the only administrative application is the production of student mailing labels by the Title IV-C project director, who volunteered to perform this task on his Apple-II microcomputer.

Training

The first five special education teachers to participate in the Title IV-C project attended four two-hour inservice sessions conducted by the grant co-authors. The inservice covered a basic introduction to computers, history, and lab sessions for practice in running BASIC programs. Thirty other special education teachers (district-wide) have attended a 1-1/2 day inservice focused on using microcomputers as instructional tools that was also conducted by the project staff. The training was made possible through Title IV-C funds.

Recommended revisions to the original proposal designated the first year as a pilot and planning year. Funds originally allocated for inservice were carried over to the second year, and the State Title IV-C office approved additional hardware purchases with these unspent funds. Subsequent budget revisions reduced allocations for inservice during the second and third years.

Emerging Roles

Even though the number of Title IV-C microcomputers has grown from two in one school to 23 in two schools, the time allocated for managing the labs by the director has not increased. During implementation of the Title IV-C project one of the original co-authors (the industrial arts teacher) was named project coordinator and given responsibility for coordinating use of the microcomputers. Teacher requests for additional software are received and reviewed by the special education teacher (project co-author), who forwards them to the director of federal projects for approval. Both the project coordinator

and the special education teacher have offered inservice training and technical assistance to the other teachers. During the first year, the project coordinator maintained his full-time teaching assignments, and received an additional salary for 5-8 hours per week for after-school planning and development activities. During the second and third years, the coordinator's course load was reduced by one class. The special education teacher who implemented the pilot project in her classroom was given five hours per week after-school time for project implementation. This year, both teachers use their regular planning time, during a shared study-hall period, for coordinating project activities. Now that the Title IV-C project is ending (July 1983), the project coordinator will return to his full-time, industrial arts position in the fall and, although desired by administrators and teachers, the continuation of a computer coordinator position is not expected.

INDEPENDENT SCHOOL DISTRICT OF BOISE CITY
Boise, Idaho

Case Study Report

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The authors are grateful to Dr. Barney C. Parker, Superintendent, for granting permission for the Independent School District of Boise City to participate in this study. We would like to thank Mr. Roy Griggs, Mathematics Supervisor, and Dr. Thomas Woychick, Director of Pupil Personnel Services, for arranging our visit and assisting the research team on site. We also appreciate the assistance given us by all the other educators who met with us and gave generously of their time to make our efforts successful.

I. SUMMARY NARRATIVE AND CHRONOLOGY

The School District

Boise is the capital and largest city in the state of Idaho. The state depends on agriculture, mining, lumber, and tourism for most of its income. Light industry, including electronics manufacturing, is also present. The legislature is conservative, and per pupil expenditures on education are among the lowest in the country.

Boise is a predominantly white, middle-class city surrounded by sparsely populated lands, and it is possible to reach rural areas within ten minutes from any part of town. Boise State University occupies a large campus near the center of Boise, but Boise does not strike the visitor as primarily a college town.

The Independent School District of Boise City covers all of Boise and extends beyond the city boundaries. It is not very large geographically, however, and it is possible to drive from one end to the other in 15 minutes. It is by far the largest district in the state of Idaho, and includes over 22,000 students housed in 38 different schools: 28 elementary schools, 6 junior high schools, 3 high schools, and 1 special education school.

The major problems faced in the Boise schools are financial. With per-pupil expenditures ranking 48th or 49th in the nation, it is difficult to find funds for hardware purchases or for the personnel to develop new microcomputer applications. Nevertheless, special projects, parent groups, and individual teachers have managed to provide a variety of microcomputers over the past four years, and the district is now in the middle of a program to expand microcomputer implementations in the schools.

The Boise City school district is large enough to have a rather complex organizational structure. Four "directors" are each responsible to three assistant superintendents. One of these directors is responsible for all pupil personnel services, including special education. Under this director, four supervisors are specifically responsible for the special education program. In addition, there are three consulting teachers, who each provide support to special education teachers in one of three geographic regions. Each consulting teacher is supervised by two or more of the four special education supervisors. In general, authority within the district is relatively decentralized, with a substantial amount of autonomy at the building level.

In Boise, 166 special education teachers and other personnel serve a total of 1,889 special education students. In addition, the special education staff includes ten "facilitators" (teachers) who serve 374 gifted/talented students.

There are 11 microcomputers in the Boise school district that are used for special education services, including the gifted/talented program. These microcomputers, and their uses, were the subject of this case study.

In addition there are a variety of other microcomputers in Boise, most of which have been purchased by parent groups or individual teachers and which represent independent applications. There is no major systematic use of these other microcomputers by special education students.

Boise does not have its own mainframe computer. For administrative tasks, the district uses the state educational computer service. Many administrators express interest in using the microcomputers for administrative applications, but only a few such applications have been implemented to date.

Overview of Microcomputers Studied

Special education (which includes both handicapped and gifted/talented students in Boise) has acquired a total of 11 microcomputers. The microcomputers are used primarily for instructional purposes. Among the applications are:

- Communication aids for a severely handicapped student, the microcomputer is fitted with a keyboard guard; applications are being developed for communication skills with hearing-impaired students at a high school;
- Basic skills instruction for speech-impaired students in a special education school, for orthopedically handicapped students in an elementary school classroom, and for special education students in a junior high school resource room;
- Computer literacy for gifted/talented students in the elementary schools.

In addition to these instructional applications, administrative uses of the microcomputers have also been established. The consulting teacher has implemented these applications using available time on one of the Apples:

- generating bus lists for the special education students;
- maintaining an inventory of software;
- preparing summer program transportation lists.

Chronology

The use of microcomputers with special education students in Boise's schools began in the 1979-80 academic year. A year earlier, a high school student suffered a fall from a horse that left her almost completely paralyzed. She retained limited control of her head and right arm, but no speech. After many months of hospitalization and rehabilitation, she started attending the separate special education school in Boise for the severely handicapped.

At first, she made little progress because she simply could not communicate. One of the district's three consulting teachers obtained district special education funds and, in the spring of 1980, bought a Bell and Howell "Black Apple" microcomputer that the student has used ever since with excellent results. Although the consulting teacher had no previous background in microcomputers, he invested his own time in learning about both hardware and software, and he quickly became the microcomputer resource person for special education.

Other special education teachers soon became actively interested in the potential of microcomputers in their own classes. A special education home economics teacher obtained a grant for a 1981 summer course at the University of Idaho in Moscow. She learned BASIC programming and, at the end of the course, was allowed to take one of the microcomputers back to her school. The teacher has used the Apple microcomputer to control food inventory in her food services class, and finds that many of her special education students can update inventories and prepare shopping lists with the microcomputer. In 1982, Hewlett Packard donated an HP-85 microcomputer to the school, and the special education teacher is now using that unit to help students take orders for food and to make change.

Also in the 1982-83 school year, three other special education teachers began to develop microcomputer uses. Another teacher at the special education school began to investigate basic skills instructional programs for use with her speech impaired students. A teacher at an elementary school, began using an Apple to teach basic skills to her orthopedically handicapped students. The resource room teacher at a junior high began taking her students to the TRS-80 computer lab in the next

classroom. These teachers worked independently of each other, but the consulting teacher provided support for all three.

Currently (spring 1983), these three teachers are continuing to use the microcomputers with their students. A special education kindergarten teacher is also now using an Apple microcomputer to teach basic skills and computer literacy. At a junior high, the resource room teacher has recently acquired an Apple microcomputer for her own classroom, as well as one of the TRS-80 units belonging to the school. (With two computers available there, special education has been able to loan one Apple briefly to a family with a handicapped student, so that the family can try out microcomputer applications in the home.)

In the winter of 1982, an Apple microcomputer was acquired for the hearing impaired students at one high school. Plans for its use are currently being implemented.

Microcomputer uses with gifted/talented students started in an elementary school where, in 1978-79, a sixth-grade teacher began on his own to use computer terminals and borrowed microcomputers in his classroom. The following year, a "facilitator" for the gifted/talented program became interested in microcomputer applications. These two put together several proposals to purchase microcomputers and, in the spring of 1980, the school's Parent Teacher Organization (PTO) provided them with a Bell and Howell "Black Apple" microcomputer.

Both of these teachers used the microcomputer to teach computer literacy and programming in 1980-81. During 1981-82, all ten "facilitators" in the district's gifted/talented program pooled their equipment budgets and bought another Apple microcomputer. With this equipment, they began a larger scale project to teach computer literacy and programming.

By the winter of 1982-83, the gifted/talented program had acquired another Apple and two Commodore 64 microcomputers of its own, and was also making use of several microcomputers belonging to different schools. The facilitators take the microcomputers to different schools on different days of the week. Gifted/talented students from several surrounding schools come to each school for their programming sessions. The microcomputer course is now organized in the form of 12-week workshops available to all of the gifted/talented elementary students.

The major events in the implementation of special education microcomputers in the Boise City School District are presented in Table 1.

Table 1: Chronology of Implementation

Boise City
School District

Date Month-Year	Event
<u>1978-79 Academic Year</u>	
Fall 1978	Sixth-grade teacher puts terminal in classroom.
<u>1979-80 Academic Year</u>	
Spring 1980	Consulting teacher purchases microcomputer for severely handicapped student with Title VI-B funds.
Spring 1980	Teacher goes to Minnesota computer conference. PTO buys one Bell and Howell "Apple" for elementary school.
<u>1980-81 Academic Year</u>	
Spring 1981	School Board orders district study of microcomputer needs.
Summer 1981	Food services teacher takes microcomputer course and acquires Apple microcomputer.
<u>1981-82 Academic Year</u>	
Fall 1982	Gifted/talented program purchases one Apple microcomputer.
	Special education teacher acquires Apple unit equipped with sound.
Spring 1982	Teacher of speech-impaired students trains with new Apple microcomputer.
	Special education teacher takes

inservice.

1982-83 Academic Year

Fall 1982

Teacher of speech-impaired students implements CAI on Apple Apple microcomputer.

Food services teacher implements HP-85 microcomputer.

Special education teacher gets Apple microcomputer in resource room.

Winter 1982

Gifted/talented program purchases two Commodore 64 microcomputers. Teacher for hearing-impaired students acquires Apple unit.

II. FEATURES OF THE MICROCOMPUTERS

Introduction

Of the 49 microcomputers in Boise, the 11 special education microcomputers were the focus of this study. Seven of these are used by handicapped students and are located in six different classrooms, in four schools. Four microcomputers are used to teach computer literacy and programming to gifted/talented elementary students.

The microcomputers are as follows:

- A Bell and Howell "Black Apple", fitted with keyboard guard located in the special education school; used full-time by a severely handicapped student.
- An Apple II-Plus equipped with disk drive and printer located in the food services room of the special education school.
- A Hewlett Packard-85 used during lunch for for an hour or two each day, plus additional practice time for some students.
- An Apple II-Plus with color monitor, disk drive, printer, and joy stick located in a self-contained classroom at the special education school and used most of the time for individualized instruction.
- An Apple II with disk drive and audio cassette tape with interface in a classroom at the elementary school is used with orthopedically handicapped students. The unit is also shared with special education kindergarten students.
- An Apple II-Plus located in a resource room at a junior high school. This microcomputer was temporarily on loan to one family so that they could experiment at home before buying their own microcomputer.
- An Apple II-Plus with disk drive located at a high school is used with hearing impaired students.

- Two Apple II and two Commodore 64 microcomputers belonging to the special education department, and a Bell and Howell "Black Apple" belonging to an elementary school are used with gifted/talented students.

Management of the Microcomputers

The special education microcomputers are relatively independent of centralized, district-level coordination. Nevertheless, the School Board has conducted a series of "computer needs" studies involving district-wide committees, outside consultants, and district task forces. These studies have resulted in: (a) the establishment of computer labs at the three district high schools; (b) preparation for a pilot elementary school lab to begin operation in fall 1983; and (c) plans for a task force to study computer needs at the junior high school level.

The special education microcomputers, like most of the microcomputers now in use in the district, were obtained primarily due to efforts of individual teachers. These teachers have been required to go through normal district channels in purchasing any equipment with school funds.

Special education is managed by the director of pupil personnel services. He is also responsible for psychological services, counseling and records services, social work services, nursing services, and attendance services. Each of these departments has its own administrative head.

Special education includes both handicapped students and gifted/talented students. It is administered by four supervisors: two who divide the district geographically; one responsible for all communication disorders services, and one who is the principal of the special education school.

Under these four supervisors, there are three consulting teachers who serve as resource persons for the special education teachers in the schools. The consulting teachers are not supervisors in any sense. That is, they have no line responsibility. They are each responsible for about one-third of the district, but their areas are not the same as those of the supervisors, each consulting teacher is responsible to two or more of the supervisors. The first two supervisors (above) and the three consulting teachers all work with teachers of both handicapped and gifted/talented students.

The technical resource person for microcomputer uses in special education is one of the three consulting teachers. He

holds this unofficial position because he was the first special educator to become interested in microcomputer uses and took the initiative to learn about them. The other two consulting teachers have not become extensively involved in uses of microcomputers, and there is no organized use of microcomputers by the special education teachers in the schools that they serve.

Requests for new equipment are initiated by the teachers and the consulting teacher. These teachers prepare a written rationale for their intended application and submit it to the appropriate supervisor. If it is approved by the supervisor, it is passed on to the director of pupil personnel services and then on to the assistant superintendent for instruction and the director of business. Microcomputer purchases from district funds must be conducted through "bids" from approved vendors. The lowest bid for acceptable equipment is then funded and acquired. This is why, for example, the less expensive Bell and Howell "Black Apple" microcomputers were purchased.

The ultimate management of the microcomputer applications is highly decentralized. Individual teachers who use the microcomputers determine the specific applications in their classrooms. The gifted/talented facilitators (teachers) manage the applications, across schools, for their program. The consulting teacher supports all these teachers--with new software, technical assistance, and transportation of equipment when necessary.

Illustrative Applications

Adaptive Communication Aide for Severely Handicapped Student. This microcomputer was the first unit for special education in the district. It was also the consulting teacher's first microcomputer project, and he has continued to be the driving force for special education applications of microcomputers in the district.

The application itself is very straightforward. A severely handicapped high school student uses the microcomputer to type everything that she wishes to communicate. She was injured in a fall from a horse in July 1978, and she is now quadriplegic with limited use of one arm, limited head control, and no speech. Intellectually, she is quite normal, but until she started using the microcomputer three years ago, communication of any kind was very difficult.

The microcomputer is a Bell and Howell "Black Apple." The only modification is a keyboard guard. This guard is a raised panel that covers the entire keyboard. It has holes over each key so that the student can rest her hand on the guard and use a finger or pencil to press the keys. Without the guard, she does

not have enough muscular control to press the desired keys without hitting other keys as well.

The student attends the special education school regularly and has the use of the microcomputer most of the day. When she is not using it, it is borrowed for other special education uses in the school.

Computer-Assisted-Instruction with Hearing and Speech Impaired Students. A special program for hearing and speech impaired students was implemented three years ago in a classroom at the special education school. The teacher now has seven students, all without speech and all with varying levels of retardation. Most of the students are of junior high school age, and they will stay at this school until they leave the district or reach 21 years old.

The classroom is large with several learning centers sectioned along the walls. One of these centers features an Apple II-Plus microcomputer with a color monitor, disk drive, printer, and joy stick. The equipment is all standard except for a cloth panel that can be attached to the keyboard with Velcro to cover the alphabetic keys. This cover simplifies the tasks for those students who use only the numeric keys and find the other keys to be a distraction.

An autistic student, demonstrates a program that teaches number recognition and matching. A large number appears on the screen and he presses the corresponding key on the microcomputer keyboard. The screen indicates that he is correct and displays a new number. This student concentrates well and gets most of the answers correct. He obviously enjoys what he is doing, and his teacher points out that he will concentrate much longer on the computer exercise than he will on paper and pencil tasks.

Other students demonstrate their skills at other, more difficult tasks. Several are working on the early parts of the Milliken K-6 curricula in math readiness, addition, subtraction, and alphabetization. The teacher brings out computer-generated record sheets that show their progress through increasingly difficult objectives over a period of weeks. She remarks that she is continually surprised at the level of difficulty with which the students can cope and at the length of time that they will concentrate on the microcomputer lessons.

The microcomputer is in use much of the day as one student at a time works on arithmetic, language, or reading. The teacher likes the Milliken programs and the Math Machine (by South West Educational Psychology Services) because they keep track of student progress as well as providing appropriate learning materials.

Microcomputers in the Special Education Food Services Program. For most of the day the special education food services room looks much like any other home economics classroom. At midday, however, it takes on the appearance of a restaurant as teachers and staff from the special education school converge to buy lunch. Virtually all the work of preparing and serving the hot and cold sandwiches, soups, drinks, and other items is done by the students. Now, with the aid of two microcomputers, the students also do much of the work in maintaining inventory lists, ordering supplies, taking orders for food, and making change for the customers.

The inventory and shopping lists are prepared on an Apple II-Plus (with a B&W monitor, disk drive, and printer), using the Apple Marketing and Personal Shopping System (MAPS). Several of the students are able to enter the amounts of items used so that the computer can produce an updated inventory and shopping list. When new supplies are purchased, the quantities are entered into the microcomputer, and the microcomputer updates the inventory again.

The newest addition to the food services room is an HP-85 microcomputer that is used like a cash register in a fast food store. Using a program written by the teacher, the microcomputer first prints out a menu. Then, when the customer makes his or her selections, a student enters them into the microcomputer and a receipt is printed out. Finally, when the customer pays, the amount tendered is entered by the student and the microcomputer shows not only the change due to the customer but also the combination of coins needed to make up the change. In the past, making change has been too complicated for most of the students in the class. The teacher hopes that, with practice provided by the microcomputer, some of the students will learn to make change on their own. In the mean time, the microcomputer lets the students perform a task that they were not able to do before.

III. ORGANIZATIONAL ISSUES

Centralization and Decentralization

The special education microcomputers constitute a highly decentralized system, when viewed in relationship to the district as a whole. Within special education, one consulting teacher has acted to develop and support microcomputer applications in the schools where he provides technical assistance. He has assumed the role of informal coordinator because of his own interests and skills; his microcomputer activities are not part of his formal job description.

Most applications of microcomputers in special education are specific to particular classrooms and teachers, and they have been implemented because of the special needs and interests of the individual teachers involved. There is a high level of coordination within the gifted/talented component of special education, where ten facilitator/teachers have cooperated to obtain equipment and establish computer literacy and programming workshops for gifted/talented students. However, this application involves only four special education microcomputers at the present time, and it was initiated by the teachers involved rather than as a part of a centralized district or special education project.

Beginning in 1981, the district has been taking steps to develop microcomputer applications that are coordinated at the district level. However, the special education applications have so far been independent of the district-coordinated microcomputer activities. While some of the special education microcomputer users have been included in the district planning activities, they have not played key roles. Both current and planned district applications are different from those in special education.

The district director of pupil personnel services, who is responsible for special education, indicates that he views microcomputers as only one of many tools for use in special education, and he has no immediate plans to establish a formal position of "microcomputer coordinator." Instead, he wants to see all of the special education consulting teachers and supervisors become more familiar with microcomputers so that they can deal with microcomputer applications in the normal course of their duties.

Special and Regular Education Interaction

There is very little formal collaboration between special and regular education in the use of microcomputers. In part,

this is because much of the special education microcomputer activity occurs at the self-contained special education school. Another factor is differences in the brands of microcomputers used in special and regular education.

Two microcomputers for special education students are located in regular schools. In both of these cases, the individual teachers have had some interaction with the regular school teachers. In one case, first grade students are brought into a classroom for the orthopedically handicapped and make some minimal use of the special education microcomputer. In the other case, a special education teacher has taken her junior high school students to the school microcomputer lab. The teacher in charge of the lab has helped the special education teacher with software and hardware problems.

This year, the special education teacher has borrowed one of the lab's microcomputers while the special education microcomputer has been in use elsewhere.

The gifted/talented program has established a formal process of cooperation with regular education. The gifted/-talented program has several microcomputers that they move from school to school each day to conduct the gifted/talented workshops on computer literacy and programming. In some schools where the workshops are held, the gifted/talented staff have arranged for the use of the microcomputers belonging to the school, so that there will be enough microcomputers to serve all the students.

Administrative and Instructional Applications

The division between instructional and administrative uses of microcomputers has not been an issue in Boise. The district uses a state-wide time sharing system for administrative purposes, and, while many administrators have studied the possibility of acquiring microcomputers, no actions have yet been taken.

Within special education, the microcomputers are almost all used either for computer-assisted-instruction or for teaching computer literacy and programming. One exception is a Bell and Howell "Apple" computer that is used on a limited basis for creating bus lists and software inventories. Special education personnel would like to expand the management applications but they do not have the time or resources to develop any major projects very quickly. Since personnel time (rather than microcomputer time) has been the limiting factor, no serious conflicts have occurred in scheduling the microcomputers.

Training

Inservice training has been organized as needed by the individuals involved with the microcomputers. Some of the teachers have taken computer courses at Boise State University or at the University of Idaho in Moscow. Others have had backgrounds or outside experiences with computers. Much of the training for the five teachers working with handicapped students has been provided by the consulting teacher, on an individual, as-needed basis.

The facilitator/teachers in the gifted/talented program organized their own training. In 1980-81, they participated in a computer literacy course presented by a district sixth-grade teacher. The next year, the gifted/talented teacher from one elementary school provided an additional semester of inservice. All of them now have a basic understanding of the microcomputers. Several have become skilled computer literacy teachers and programmers.

With the development of district-wide microcomputer projects, additional inservice training is becoming available. For example, in the school that will house the district's pilot lab for elementary schools, most teachers, including the special education teachers, have already received some inservice training. With the advent of the new lab, additional training will also be provided for teachers from other schools.

Emerging Roles

The role of one of three special education consulting teachers has enlarged with the growth of microcomputer applications in special education. He now acts as the technical support person. This remains an informal position. Since there is no formal microcomputer system in special education, there is no administrative role. The same consulting teacher does, however, assist in coordinating the special education and gifted/talented applications. Within the program for gifted/talented students, the planning, purchasing, and coordination are group activities conducted by the ten facilitator/teachers.

At the district level, the math supervisor for the district is the head of the computer committee. However, this committee has not been extensively involved with the special education uses of microcomputers.

LARAMIE COUNTY SCHOOL DISTRICT NUMBER ONE

Cheyenne, Wyoming

Case Study Report

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The authors are grateful to Dr. Byron A. Barry, Superintendent, for granting permission for the Laramie County School District Number One, to participate in this study. We would like to thank Robert L. Morissette, the Coordinator of Mathematics and Computers, for arranging our visit and assisting the research team on site. We also appreciate the assistance given us by all the other educators in Cheyenne who met with us and gave generously of their time to make our efforts successful.

I. SUMMARY NARRATIVE AND CHRONOLOGY

The School District

Cheyenne, the capital of Wyoming, is a low-density, urban community with a population of about 47,000. It is situated on flat and slightly rolling terrain, east of the Rocky Mountains, in Southern Wyoming. The community contains a mix of professional, clerical, light-industry, and military personnel. Major employers are the state government, a nearby military base, and the public schools.

Laramie County School District Number One provides educational services for all students in Cheyenne and some from the surrounding areas (including children of personnel at the nearby military base). The district has 23 elementary schools, 3 high schools, and 3 junior high schools. The current school enrollment of about 13,000 represents a slight decline (about 1,000) over the past few years. The student population is 79 percent white, 12 percent Hispanic, 7 percent Black, and 1 percent each, Asian and Native American.

Special education in the district is provided by the Research and Pupil Personnel Services division. The central administration of this division includes a director and an executive director. There are variety of support personnel, including 58 special education teachers, 12 diagnosticians, and 13 school nurses. The division also includes an Educational Resource Center (E.R.C.) which provides technical assistance, materials, and training to special education teachers and staff in the schools. Special education services are provided to 1,486 students.

There are a variety of computers and computer uses in the school district. District administration has used mainframe time-sharing and presently uses a Burroughs computer for payroll, accounting, student records, and other administrative functions. At one time, computer science courses in the high school used time-sharing terminals connected to a university computer and, later, terminals linked to the district's central computer. Currently, however, instructional applications rely solely on the microcomputers that have been acquired during the past six years.

For instructional applications, there are two distinct groups of users in the school district. One of these is the Vocational Education Department. They purchase their own equipment (microcomputers and minicomputers) and plan and coordinate its use in business education, vocational education,

and industrial arts. There is a committee established to plan and supervise the Vocational Education computer applications.

The other group of users consists of all of the other teachers in the district who are currently using microcomputers. These teachers use microcomputers for secondary math and computer science courses, for computer-assisted instruction and computer literacy at both elementary and secondary levels, and for individualized instruction in special education. Altogether, this group currently has about 130 microcomputers: 63 in high schools, 36 in junior high schools, 26 in elementary schools, and 5 in district instructional offices.

Overview of Microcomputers Studied

The 130 microcomputers that are used for instructional purposes have been acquired over a six-year period and include a variety of different types. There are 66 TRS-80 units, 44 Apple units, 14 Commodores, and 6 others (Altair, MTI, 3M). Most of the units (99) are located in junior and senior high schools. Implementation in secondary schools has been the major focus in the district, although elementary applications are growing.

Special education programs in all secondary schools have microcomputers. Two of these--including the first microcomputer for special education--were funded by the local chapter of the Association for Children with Learning Disabilities (ACLD). The remainder were funded with district special education funds. The Educational Resource Center (E.R.C.), in the district's Research and Pupil Personnel Services division, has distributed these units to special education teachers and has provided some training and technical assistance regarding their use.

The microcomputers are used for a variety of applications, which include the following:

- Individualized instruction for secondary special education students--learning labs in each of the six secondary schools use microcomputers to support educational objectives and reinforce (with mainstreamed students) curriculum topics from regular education programs.
- Each of the secondary schools includes training in the use of computers as an elective area. At the high schools, this instruction includes courses in advanced programming.
- In both elementary and secondary schools, some

teachers are using microcomputers for computer-assisted instruction in academic areas.

- At one high school, word processing programs on microcomputers are used to improve students' composition for English courses, and in journalism classes and projects (e.g., the student newspaper and yearbook).
- Some secondary schools have microcomputers and software collections in the school libraries. Students and teachers can use the equipment to familiarize themselves with computer operations, or to learn or practice skills through computer-assisted instruction.

Chronology

The first microcomputer in the district was an Altair purchased in 1977 with school building funds for the math program at a high school. A year later this same math program acquired another Altair, plus a Radio Shack Model II. The high school math programs had been using time-sharing terminals, connected initially to a university's mainframe system and, later, conducted through time-sharing with the district's own (Burroughs) computer. Beginning in 1979, other secondary schools also began acquiring microcomputers for math and computer courses. In 1981, one high school cut its link with time-sharing and batch processing systems, and switched completely to microcomputers for instructional use. By 1983, all secondary math/computer programs were relying solely on microcomputers.

The first two microcomputers acquired for computer-assisted instruction (CAI) and computer literacy -- outside secondary math/computer science courses -- were purchased with district funds for: 1) a junior high school teacher (spring 1978) and 2) a fifth-grade elementary teacher (spring 1979). These teachers were very interested in the potential instructional value of microcomputers, and also felt it was important to introduce the students to this new technology.

The first microcomputer used for instruction in special education was acquired by a high school resource room teacher in May 1980. A TRS-80 Model I was purchased with funds provided by the local chapter of the Association for Children with Learning Disabilities (ACLD).

All of these early applications of microcomputers in the district were initiated by teachers, and decisions regarding

implementation and use were highly decentralized. The only major exception to this was a district-wide planning of curriculum standards for the high school computer science courses, which occurred in spring 1979. At that time, however, most of the computer courses relied heavily on time-sharing and batch processing computer systems. The focus of the planning was on programming languages, rather than on equipment (e.g., microcomputers).

By the fall of 1980, however, microcomputer implementation was in place and the district began to take steps to organize and support it. A coordinator of mathematics and computers was hired and given the responsibility to direct and assist computer implementation in the schools. Two committees (one elementary and one secondary) were formed to plan future instructional uses of the microcomputers. In spring 1981, the first district-wide inservice training on microcomputers was offered. Instruction was provided by the coordinator, and teachers received recertification credit for their participation.

During the 1981-1982 school year, use of microcomputers increased, but efforts to coordinate applications were not successful. For one thing, a great variety of different types of units were in use in the district. Users felt they benefited more from interaction with others who used the same equipment, than from more general inservice training or technical support. The elementary and secondary planning committees were reorganized into TRS-80 and Apple "users groups." Additionally, many schools were developing their own directions in implementation, usually with the impetus of one or two local teachers who were enthusiastic and experienced in microcomputer applications. With Altairs, TRS-80s, and Apples already in use in the district, one high school, in fall 1981, purchased 12 Commodore PETs for instructional applications. A Title IV-C experimental project, using word processing to improve student composition skills, was initiated at one high school.

In the spring of 1982, the Superintendent placed a "freeze" on additional microcomputer purchases with district funds until better organization and planning for instructional applications could be obtained. A centralized district planning committee for instructional use of microcomputers was established. Individual representatives from each school participated in this committee which met regularly during the fall of 1982. In February 1983, this group, under the direction of the district coordinator, submitted a planning report for future use of microcomputers.

The major events in the implementation of microcomputers in the Laramie County School District are presented in Table 1.

Table 1: Chronology of Implementation

Laramie County
School District

Date Month-Year	Event
<u>1977-1978 Academic Year</u>	
Fall 1977	First microcomputer, Altair, purchased for high school math program.
Spring 1978	First microcomputer in a junior high school.
<u>1978-1979 Academic Year</u>	
Fall 1978	Second Altair microcomputer and TRS-80 Model II purchased for high school math program.
Spring 1979	District-wide planning committee for high school computer science programs.
May 1979	First microcomputer in an elementary school.
<u>1979-1980 Academic Year</u>	
Fall 1979	Microcomputers introduced in math/computer science courses at a second high school.
May 1980	Microcomputer acquired for CAI in special education at a high school.
<u>1980-1981 Academic Year</u>	
Fall 1980	Additional microcomputers acquired for secondary math/computer science courses.
Fall 1980	District hires coordinator of mathematics and computer science.

Fall 1980	Two committees (elementary, secondary) formed to plan future instructional uses of computers.
Spring 1981	First district-wide inservice training on computers offered.
 <u>1981-1982 Academic Year</u>	
Fall 1981	Second microcomputer acquired for special education at a high school.
Fall 1981	Twelve Commodore Pets purchased with basic skills grant for "alternative" high school.
Fall 1981	Title IV-C experimental project initiated using microcomputers as word processors.
Fall 1981	Computer science program at one high school switches from district main-frame computer to microcomputers.
Fall 1981	District-wide planning committees reorganized into "Apple Users" and "TRS-80 Users."
Spring 1982	Cheyenne Teachers Education Association presents Saturday morning workshops on microcomputers.
Spring 1982	District special education administrative offices purchase TRS-80 Model III.
Spring 1982	High school student computer club offers evening computer classes for adults.
Spring 1982	Superintendent places a "freeze" on district-funded microcomputer purchases.
Spring 1982	Centralized district planning committee established.
Summer 1982	Local teachers present a one-day workshop on microcomputers for Wyoming State Department of Education staff.

1982-1983 Academic Year

Fall 1982-Winter 1983	Microcomputers provided by E.R.C to secondary special education programs.
Sept. 1982	Computer coordinators designated at one junior and one senior high school.
Fall 1982	Additional microcomputers purchased for secondary math/computer science programs.
Fall 1982	Microcomputers purchased with PTA and school building funds in elementary schools.
Feb 1983	Comprehensive Planning Report completed by district planning committee and present to the Board of Trustees.
April	District-wide inservice training offered on "advanced uses of microcomputers."

II. FEATURES OF THE MICROCOMPUTERS

Introduction

The instructional microcomputers in Laramie County School District Number One are located in all 6 secondary schools and in 17 (of 23) elementary schools. In addition to the microcomputers in the schools, five units are located in central administrative offices for instructional assistance (software review, special education records, and technical assistance).

In secondary schools, the predominant use of microcomputers is for computer literacy and computer programming courses. All three high schools and two of the junior highs have microcomputer "labs" where numbers of units are located. The other junior high school has five microcomputers that are distributed among math classrooms but can be brought together for group instruction.

Special education programs in each of the secondary schools also have one or two microcomputers per building. Special education teachers share these units and use them for individualized instruction. The type of equipment, software, and methods used for computer-assisted instruction in secondary special education varies from building to building. In all situations, however, the particular applications are geared to the specific needs and educational objectives of the students. In the elementary schools, some special education teachers are also using microcomputers for individualized instruction with their students. In those cases, however, the microcomputers have not been specifically allocated to the special education teachers, but are available for use by both special and regular education.

In general, microcomputers in the secondary schools are stationary and dedicated for use in the particular instructional program that has acquired them: in math/computer labs, in special education rooms, in libraries, in word processing centers, etc. In elementary schools, where there are markedly fewer microcomputers--only about one per school--they are made available to many teachers and students in each building. In some cases the microcomputers are on carts that can be wheeled between classrooms and storage locations. In one elementary school, three microcomputers are located in a partitioned section of the library. Small groups of students and teachers are scheduled to use these units during each period of the school day.

The extent to which the microcomputers are utilized varies

across the district. Microcomputers in math/computer labs in the secondary schools are in use almost constantly during the school day. Microcomputers in secondary special education classrooms are also used heavily, about 50 percent of the day. The lowest utilization of microcomputers occurs in elementary schools, where most implementation has been initiated only in the last year. In at least one elementary school, use was very extensive and the three units in a media center were utilized regularly every day. In other elementary schools, however, teachers are just beginning to learn how to use the equipment and use of some microcomputers is limited to a few hours each week. Across the district, it was estimated that about 100 teachers and about 2,800 students were making instructional use of the microcomputers.

Management of the Microcomputers

During the six years that microcomputers have been in use in Laramie District, management of the applications has been highly decentralized. For the most part, individual users, and/or instructional programs within specific schools, have determined the type of equipment to be purchased and the use that would be made of it.

This is true even where a similar purpose is common to applications across a number of schools. For example, computer literacy/programming courses and special education programs in all secondary schools use microcomputers. Nevertheless, in each school the applications are essentially unique and the equipment is different. This incompatibility of equipment has been a disincentive to mutual planning and sharing of resources.

From 1980 to 1982, district efforts to coordinate microcomputer applications consisted largely of providing technical assistance, inservice training, and general support to users. During the past year, however, the Superintendent and the coordinator of mathematics and computers have taken further steps to provide a stronger role for central administration in management of the computers. One example of this is the recent (1982) policy that all decisions on microcomputer acquisition with district funds be managed by the coordinator. Another aspect of this centralized management is the establishment of a planning committee for instructional use of microcomputers. This group has produced a three-year plan for instructional use of microcomputers in the schools.

In addition, some building principals are formalizing the management of microcomputers in their own schools, by identifying one key person to coordinate applications across classes. During the 1982-1983 school year, two school-based

"coordinators" were appointed by principals.

Illustrative Applications

To provide an idea of how the microcomputers are being used in the Cheyenne schools, three illustrative applications are described below.

Computer-Assisted Instruction in Junior High School Learning Lab. The special education program at a junior high school has two TRS-80 Model III microcomputers with disk drives and printers. One is located in a self-contained classroom; another is in the learning lab.

Approximately 50 students use the learning lab each day; but no more than 10 at a time. The lab is staffed with two special education teachers and a teacher assistant. The microcomputer is scheduled in half-hour blocks for each student. Specific educational software which reflects individualized educational objective is selected for each student. New students are scheduled for a one-hour introductory lesson on computer operations. There are also posters, on the wall near the microcomputer, that remind students of the steps required to operate the unit.

The educational software is kept in ring-binders and organized by subject area. In addition to curricular drill-and-practice materials (in mathematics, spelling, vocabulary, reading), the teacher also uses word processing software with the students to improve their composition skills. She also has commercial software on typing-training.

When it is time for a student to use the microcomputer, the teacher gives the student a small card identifying the software to be used. The card also indicates the number of times each instructional package should be run. In most cases, the students are required to run each CAI program at least twice--the teacher feels that repetition of the materials is useful.

After using the microcomputer, the student returns this card to the teacher with marks indicating that the lessons were completed. The teacher uses these cards to maintain a record of the CAI that each student has completed.

CAI/Computer Literacy in Elementary School Media Center. The impetus for microcomputers at one elementary school actually came from a local parents group, "Parents That Care" (PTC). They wanted microcomputers in the school and the principal actively supported their initiative. The PTC provided some seed

money towards the purchase of the first unit; district and school funds were used to provide the rest. Three Apple II units with disk drives and one printer were purchased.

The microcomputers were set up on tables in a corner of the school library, creating a "computer nook." The students are scheduled for half-hour periods throughout the day to use the microcomputers. The teacher told us that the microcomputers are treated as "our" program--the school's and the students'--and "everyone is responsible" for them. All users are on an "honor system" and there is usually no direct supervision in the library.

The coordinating teacher for the microcomputers is a second grade teacher. When the school received the computers, she set up a "multiplier effect" inservice and student training program. She individually taught each teacher (19) how to use the microcomputers. Each teacher came to the media center during a free period, along with five students from the teacher's class. These initial students were then required to each train one other student. As each student was trained, they in turn had to train another student, until all (430) students in the elementary school knew how to use the equipment. Now, all, teachers use the microcomputers for instructional support with their students and participate in the regular scheduling of students to the computer lab.

CAI/Word Processing for High School English Classes. A Title IV-C experimental project uses microcomputers as word processors to enrich high school students' composition skills. The project started in fall of 1981 and the first year (1981-1982) was a pilot study--with only fifteen students. During the second year, 36 students participated officially along with a number of other students and teachers.

The originator of this "Developing Computer Software to Teach Writing Skills" project was a high school English teacher/department chairperson. During the 1982-1983 school year, he was appointed "computer coordinator" for the school and provides technical assistance to other users. Beginning in fall 1983, half of his time will be devoted to computer applications in the high school.

The project is very straightforward. Students are trained to use a word processor (Scripsit) to write their compositions for English classes. There are four microcomputers in this program. Each is a TRS-80 Model III with dual disk drives. There are also two letter-quality printers. Three of the microcomputers are in a converted counselor's office; the fourth is in the teacher's office.

Students use the microcomputers during free periods or study hall periods. Students can schedule themselves for use of the computers or can drop by to see if one is available. The teacher reported that the program has been very successful: student use of the microcomputers for word processing is high; definite improvements in composition skills have been evidenced; students are producing more writing now than before using the microcomputers.

An additional effect of the project has been the recent introduction of microcomputers with word processors into the journalism courses at the high school. The English teacher has trained the journalism teachers. Two more TRS-80 Model III units were purchased. The microcomputers are used not only in the journalism courses but also to compose the school's student newspaper.

III. ORGANIZATIONAL ISSUES

Centralization and Decentralization

The purchase of microcomputers appears to be the most centralized aspect of microcomputer implementation in the district. Purchase of equipment with district funds requires final approval by the Superintendent. Teachers' requests for microcomputers are first screened by the district's planning committee which includes representatives from each school. Based on the teachers' specified interests and needs, additional microcomputers are purchased and allocated. Once a microcomputer is allocated to a school or teacher, its specific location and use are determined by the principal or teachers within the school. In two schools, computer coordinators have been appointed by the principals.

Microcomputer purchases are not handled by the district's committee if special funding is involved. Special education microcomputer purchases are coordinated separately by the Educational Resource Center. The microcomputers are allocated to special education classrooms in specific schools. However, once the microcomputers are in the special education classrooms, their scheduling and use is determined by the special education teachers.

Efforts to coordinate the district's microcomputers have included various computer committees established by the coordinator of mathematics and computers. The original computer committee was organized into groups of elementary and secondary teachers to discuss educational applications of the microcomputers. The following year, the committee regrouped into "Apple users" and "TRS-80 users" to facilitate the sharing of resources and software. The most recent committee was organized at the Superintendent's request in the fall of 1982, to design a three-year plan for microcomputer use in the district. The Superintendent desired more centralization because some microcomputers in the district were not fully used, even though teachers kept requesting more units. Also, he was concerned about the problem of software incompatibility with so many different kinds of hardware in the schools. The committee's plan, completed in February 1983, outlines a purchasing schedule and implementation plan for future microcomputers, with recommendations for hardware types and software, training, and coordination procedures.

The Vocational Education Department has a separate but similar committee for planning and coordination, as the director sees their microcomputer needs as being different. The special

education administration also has some separate coordination efforts through the Educational Resource Center, which has acquired microcomputers for each secondary school's special education department and has a software collection in a central resource library.

Another centralization step supported by the district coordinator and the planning committee is the identification within schools of "resident experts" in microcomputers. These key persons would act as computer coordinators for the staff by providing technical assistance, informal training, new software programs, and other resources. At two schools, computer coordinator positions have been formalized by the principals and time has been allocated to computer responsibilities for these coordinators. Through the computer coordinators at each site, the district's coordinator hopes to manage the district's computer programs more effectively. In addition, communication between schools about microcomputer use is expected to improve.

The district's coordinator has attempted to centralize the district's software. He would like to consolidate all the programs into a master collection with a catalog, but the schools have not yet provided him with their software listings. Presently, individual teachers or departments within each school have separate software collections. School software can be acquired with building funds or classroom supply monies.

The coordinator feels that this difficulty in consolidating the software reflects the basic decentralization of actual microcomputer implementation in each school. It has been his philosophy to simply provide resources and support to interested teachers, and not to control the process. (In 1981, a Title I grant required some teachers to adopt microcomputers and attend training sessions. This resulted in negative feelings and unused equipment.) Basically, the coordinator handles purchase requests, acquires new software, provides some "hands-on" experience to new users, coordinates some training, and organizes computer committees.

Special and Regular Education

No unusual collaboration occurred between special and regular education in the adoption of microcomputers. One of the first microcomputer users in the district was a high school special education teacher. She secured funding in 1980 from the Association for Students with Learning Disabilities (ASLD) to purchase a TRS-80 Model I. Apart from a math/computer science teacher, she was the only other staff person at the high school with a microcomputer and, at that time, the only special education teacher in the district to utilize the new technology.

Based on her success in using the microcomputer for computer-assisted-instruction in basic skills with her students, other teachers soon became interested in microcomputers.

As more microcomputers were purchased at this high school, the special education teacher was instrumental in providing introductory training and securing software on an informal basis for the new users. The computer science teacher was also a resource to the other teachers. He provided technical assistance, helped with software, and equipment maintenance. Both regular and special education teachers continue to rely on these initial users for training and technical assistance.

In the fall of 1981, the special education teacher worked with the other teachers and with the district's coordinator to establish a TRS-80 users group in the district. The purpose of this group was to informally discuss applications and software programs, and to share resources. Both regular and special education teachers in the district participated and no distinction was made between the two staffs.

The director of pupil personnel services, who is responsible for special education services, decided in 1982, to provide all secondary special education learning labs with at least one microcomputer. Several high school special education teachers had already acquired units and there was expressed interest among the others for microcomputers. The funding and purchase of the special education microcomputers was coordinated by the director of the Educational Resource Center. The E.R.C. is a district-wide curriculum and resource library for special education teachers. There are plans for the E.R.C. to extend its resources and services to include microcomputer use and special education software programs. However, to date only one education resource specialist is adequately prepared to provide training and software. Consequently, special education teachers still rely, to some degree, on the district coordinator and on other teachers for assistance. They attend the general training sessions provided by the district. There has been no inservice training specifically tailored to special education applications.

The E.R.C. purchases and allocates microcomputers in special education independently from other district purchases. Management and use of the microcomputers are left up to the individual special education teachers. At the school level, collaboration occurs informally between regular and special education teachers: they exchange software, resources, and experiences. In two secondary schools, the "computer coordinators" assist special education as well as other teachers with operating instructions, purchasing software, and maintenance. This assistance and informal collaboration between teachers has

been important to the utilization of the microcomputers in the secondary school learning labs.

There is very little use of microcomputers by elementary special education teachers. None of the elementary special education teachers have acquired their own microcomputers. Use of microcomputers by elementary special education students is limited to those schools where interest among the special education staff leads to shared use of the available equipment.

Administrative and Instructional Applications

The district has not developed plans to use microcomputers for administrative applications. A mainframe system has been used for administrative functions. After using the University of Wyoming's mainframe computer on a time-sharing basis for computer science courses in the high school, the district decided to purchase its own computer system. The district's computer (Burroughs) was acquired for central administration and for computer programming courses at the high schools (but for no other instructional purposes). With increasing use of the computer for administrative functions, secondary programming courses have transferred completely to reliance on microcomputers.

There are a few instances in the district where microcomputers acquired for instructional purposes are also being used for some administrative tasks. In the elementary schools, the microcomputers are used almost exclusively by the teachers for computer-assisted instruction: drill-and-practice, reinforcement, and skill games. However, a few teachers are also using the microcomputers for classroom management tasks, such as grade reporting and curriculum inventories. At the junior high level, the microcomputers are used for computer-assisted-instruction in computer labs or in special education learning labs. However, one junior high school has a microcomputer in the office for student records and attendance, and the special education teachers use their microcomputer for student evaluation data and for scheduling IEP meetings. A few teachers are using word processing with microcomputers to write curricula. Microcomputers in the high schools are also used for career counseling and for cataloging short story collections in the high school library.

The history of microcomputer adoption in the district explains to some degree the emphasis on instructional usage. The first microcomputers in Cheyenne were acquired, without district involvement, by individual teachers using a variety of local funding sources. Acting independently of each other, these initial adopters were interested in using microcomputers for

instructional purposes (computer literacy/programming and CAI) in their classrooms. The successful classroom use of the first microcomputers generated interest among other teachers who then requested the district to purchase more microcomputers. In response to these decentralized developments, the Superintendent created the position of coordinator of mathematics and computers. The new role clearly placed microcomputer use within curriculum and instructional areas.

At the same time, central administration began budgeting funds for the purchase of microcomputers for instructional use. It was the coordinator's responsibility, in conjunction with the district's planning committee, to review teachers' requests for microcomputers and, in turn, to coordinate the allocation of units for instructional purposes. Most of the software purchased by the district (both public domain and commercial) has been educational in nature.

Training

The initial adopters of microcomputers in the Cheyenne schools were either self-taught or received training outside of the district. It was not until the position of coordinator of mathematics and computers was created that district-sponsored training was offered to the teachers. Beginning in the fall of 1980, the coordinator has regularly provided some introductory orientation and training in computer operations to individual teachers acquiring new microcomputers. Introductory training also has been provided by the coordinator in after-school sessions at the high school computer labs. The workshops covered computer operating instructions and were oriented towards either TRS-80 or Apple microcomputer users. The coordinator also has offered evening courses in programming that could be taken by teachers for recertification credit. Initially, the courses were too advanced for the teachers' experience and interest. Now, however, teachers are interested in learning programming and the course will be re-offered in the fall of 1983.

In the spring of 1982, two initial users of microcomputers in the district (a high school computer science teacher and an elementary teacher) offered a series of two four-hour, Saturday morning workshops to 22 teachers. These workshops, which were repeated in the fall, were sponsored by the Cheyenne Teachers Education Association. The workshops included an introduction to computer operations and BASIC programming, and demonstrations on debugging programs and adapting software to meet instructional needs. The district now sponsors the workshops four times a year and provides substitute teachers so they can be held during the school week. It is estimated that over 200

teachers have attended at least one of the workshops.

High school students have been teaching a five-week evening course in computer literacy and BASIC programming as a fund-raising event for their computer club. The course, first offered in the spring of 1982, has been heavily subscribed by both teachers and residents in the district. The introductory course has been taught five times and is now followed by a new course in advanced programming.

In fall 1982, a high school English teacher, who initiated an experimental project on using microcomputers to develop students' writing skills, started providing word processing workshops to teachers. The positive response among staff members has resulted in three additional word processing in-service sessions this year.

In addition to these training opportunities, the University of Wyoming offers a semester course in BASIC programming, and the Wyoming State Department of Education in Cheyenne provides state-wide workshops on microcomputer use and educational applications. Another source of training in the district has been the informal assistance provided by teachers to each other in the schools. Teachers active in using microcomputers have served as a resource to other staff on an individual need basis. In one junior high school, a teacher is responsible for ongoing training as part of his allotted time to the school's microcomputer program.

The "resident expert" in microcomputers at an elementary school has taught every teacher, aide, secretary and the principal during her free periods to operate the microcomputers. She also trained five students at each grade level, who in turn each trained more students until everyone in the school was able to utilize the microcomputers.

Emerging Roles

In the fall of 1980, the Superintendent created the position of coordinator of mathematics and computers as part of his efforts to centralize the district's computer programs. The Superintendent believed that someone was needed to begin determining the district's microcomputer needs and to coordinate the acquisition and allocation of new equipment.

The coordinator divides his time between the district's mathematics programs and managing the microcomputer use in the schools. Part of his main responsibility is the coordination of all microcomputer purchases with district funds. All requests for microcomputers are reviewed by a planning committee and the coordinator, before final purchasing decisions are made. Once

microcomputers are allocated to teachers, the coordinator provides some introductory training and technical assistance. He has presented district-wide workshops on computer literacy and operations, and several evening courses on microcomputer programming for teachers.

The coordinator has been collecting and reviewing public domain software which he makes available to the schools. Also, he purchases and reviews commercial software for a district master collection. The coordinator has plans to set up a library of software with a catalogue for the teachers.

In addition, the coordinator has been instrumental in organizing several committees over the last three years to assist microcomputer implementation in the district. The first committee consisted of elementary and secondary groups of teachers, representing each school, who discussed the possible use of microcomputers in the schools. Later, committees were organized of microcomputer users with different hardware types so they could share software and resources. Presently, the coordinator chairs a committee of teachers that has developed a three-year plan for microcomputer purchases and programs in the district. It is the coordinator's responsibility to insure the implementation of the plan's guidelines and recommendations.

The only other new roles in the district are those of computer coordinators in a few schools. Usually, an early adopter of microcomputers or a computer enthusiast informally takes on the role by serving as a resource to the other staff. In two schools, the position has been formalized with time allocated to computer responsibilities including training, maintenance, technical assistance, and acquiring new software programs. The three-year microcomputer plan recommends that each school designate a key teacher as coordinator with scheduled time for computer assistance.

COMMACK UNION FREE SCHOOL DISTRICT
Commack, New York

Case Study Report

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I. SUMMARY NARRATIVE AND CHRONOLOGY

The School District

The Commack School District is located in Suffolk County on Long Island, New York. The district serves a community of approximately 41,000, with the majority of the residents representing socio-economic levels ranging from upper-middle to lower-middle class. The district does not have any industry within its boundaries, so employment is found in neighboring areas of Long Island or within New York City.

The current student enrollment in the Commack School District is 9,200, reflecting a predominately white ethnic composition. This student population has declined at both the elementary and secondary levels. Eleven years earlier, in the year of the district's highest enrollment, it had a total of 15,200 students and 21 school buildings. The steady decline in enrollment has resulted in staff layoffs and school closings. The district is now housed in seven elementary schools, two junior high schools, and two high schools, with administrative offices in an old school site.

Approximately 600 students receive special education services in the district, from a staff of 35 special education teachers and 40 teacher assistants. Each of the elementary schools has a resource room and reading lab to serve special education students, and five of the seven elementary schools have a self-contained classroom as part of their special education program. At the secondary level, all the schools have a resource room and self-contained classrooms for their special education students.

The district makes extensive use of several different computer systems, some directly serving students with special needs. The district's largest system, two Hewlett-Packard 300 minicomputers with 70 interactive terminals and 21 printers, is used primarily by special education and remedial students for drill and practice and problem-solving in reading, language arts and mathematics. Some of the terminals are used in the high schools for programming courses and in the guidance offices for career counseling programs. There are also ten time-sharing terminals that are part of the BOCES/LIRICS instructional computer system. These are used by high school students in both secondary schools for advanced programming and by special education students in one elementary school for basic skills instruction.

The district also has 70 microcomputers (55 Commodore PETs,

1 Texas Instrument, 13 Compucolors, and 1 Apple II-Plus), which are used for a variety of instructional applications with special and regular education students. Of these, 57 can be considered part of the same organizational system: the 55 Commodore PETs, the 1 Texas Instrument, and the one Apple II-Plus. The 13 Compucolors are a separate system located at the high schools for computer science courses.

In addition, the district has two Commodore 8032s in the central office, which are used by the director of student services for administrative and management functions.

Overview of Microcomputers Studied

Of the 70 microcomputers in the Commack School District, this case study focused on the 57 used primarily with special education and remedial students. Because the district has a separate computer system for formal compensatory education (drill and practice and problem-solving) and computer-managed-instruction, the microcomputers tend to be used more for individualized or innovative purposes. Among the applications are:

- In one elementary school resource room, two second-grade and five sixth-grade special education students are learning to write their own computer programs in BASIC.
- Junior high special education and remedial students are using Commodore PETs for word processing to develop their written expression skills. The students have used this process to produce several magazines of their stories.
- Elementary students are using district-developed "early-learning" software that focuses on the basics of reading and mathematics. The "early learning" programs involve such skills as memory activities, problem solving, visual discrimination, likenesses and differences, and spatial relationships.
- All math students at the junior high level attend a ten-day computer awareness course which includes "hands-on" experience in operating the computer and an introduction to programming.
- Kindergarten and first-grade students are learning LOGO language on a Texas Instrument microcomputer located in a resource room.

Chronology

In the fall of 1977, a high school computer teacher and an elementary special education teacher proposed a pilot program to introduce computers to elementary students. Prior to that time, computer use in the Commack school district had been limited to teaching computer science in the high schools.

With Title IV-C funds, Project CAL (Computerized Accelerated Learning) was established at one elementary school. All students in grades K-6 had access to a BOCES/LIRICS computer terminal in a resource room for basic skill instruction. (BOCES/LIRICS is an instructional computer system with on-line, time-sharing service for participating districts in Suffolk County.)

Based on the positive results of the pilot project, the district decided to expand the program to all the elementary schools in the following school year. However, the cost of more time-sharing BOCES/LIRICS terminals was prohibitive, so the district purchased ten Commodore PET microcomputers with Title IV-B funds instead. A microcomputer was placed in each elementary school's resource room. The special education teacher originally involved in the pilot project was responsible for training one staff member at each school in computer operations. Parent volunteers were in turn trained during afternoon workshops, to assist in the resource rooms.

The lack of appropriate software prompted the district to develop its own microcomputer programs. During the summer of 1979, the special education teacher developed approximately 80 "developmentally sequenced, multi-sensory" software programs. High school students were then hired to program these to the developed specifications. (The programs are now sold to other districts through a non-profit corporation, COMCAL, established by the district in 1980. The revenues are reinvested into the district's educational programs.)

As Commack's computer activities continued to expand, a part-time district position of computer curriculum specialist was created for the special education teacher in the fall of 1979. In this position, under the direction of the director of student services, she is responsible for developing computer projects, providing staff development, and coordinating the purchase, allocation, and use of equipment. (The special education teacher retained her teaching responsibilities for the rest of the time.)

The computer curriculum specialist offered the first

teacher training session on computer awareness in the spring of 1980. Presently, five computer courses are available to teachers, including computer awareness, programming, word processing, and computer graphics. In the summer of 1980, the computer curriculum specialist was instrumental in establishing a regional committee of teachers and administrators to develop a comprehensive K-12 computer literacy program.

In the fall of 1980, additional Commodore PET microcomputers were purchased with Title IV-B funds for the resource rooms at the junior and senior high schools. Word processing and programming were implemented for the special education and remedial students served by the resource rooms. At the same time, the district was awarded a state grant, using (SEA) Part B (P.L. 94-142) flow-through and ESEA Chapter 1 funds, to purchase two Hewlett-Packard minicomputers and 70 terminals for a computer assisted instructional system with management capabilities in reading, math, language arts and problem-solving. About 1500 students in grades 1-12 use the terminals for drill and practice and diagnostic analysis of skills. Since the terminals are devoted exclusively to the STRIDE/DOLPHIN program, it allows the microcomputers to be used for applications not requiring recordkeeping of students' performance.

In the academic year 1981-82, more Commodore PET microcomputers were purchased for the elementary schools, with ECIA-Chapter II and PTA funds. The microcomputers were placed on carts to be used in each teacher's classroom on a rotating schedule. Additional computers were purchased with ECIA-Chapter II funds to equip the junior high schools with computer labs, to be used by all math students for a ten-day computer literacy course.

During the same year, programming activities were extended to elementary school resource rooms. A programming course was implemented under Project APT, a Nassau County BOCES Title VI research program, for elementary, gifted handicapped students. It has since expanded to an intermediate, self-contained special education classroom. Instruction is provided by a federally funded computer intern who is a graduate student from a local college. In addition, a multi-year research and curriculum writing study was started, to teach LOGO to primary grade students.

The Huntington/Commack Collaborative Education Software Project was initiated in the 1982-83 school year to review and evaluate commercial software programs. In September 1982, a special session on computer awareness was held for the elementary and secondary principals. Four workshops, each covering one aspect of the computer program, were conducted for the district's administrators. Both inservices were intended to inform those in leadership positions of the district's computer ac-

tivities, and to encourage further involvement and support.

The major events in the implementation of microcomputers in the Commack School District are presented in Table 1.

Table 1: Chronology of Implementation

Commack

Date Month-Year	Event
<u>1977-1978 Academic Year</u>	
Sept. 1978	Project CAL (Computerized Accelerated Learning) provided a BOCES/LIRICS computer terminal in one elementary school.
June 1978	Project CAL - N.Y. State Title IV-C mini-grant for software program development by gifted high school students under the direction of the special education teacher.
<u>1978-1979 Academic Year</u>	
Sept. 1978	Expansion of Project CAL, with purchase of ten Commodore PETs for elementary-level, special education resource rooms.
June 1979	Software programs coded in BASIC for microcomputers were developed by the special education teacher using district-paid high school students to program them.
<u>1979-1980 Academic Year</u>	
Sept. 1979	Creation of part-time position of computer curriculum specialist for elementary special education teacher.
March 1980	First teacher training sessions on computer awareness, BASIC programming, word processing, and computer graphics (14 hours).
April 1980	Establishment of nonprofit corporation, COMCAL, to sell microcomputer software.

June 1980

Participated in regional K-12 computer education committee to develop comprehensive computer literacy curriculum.

1980-1981 Academic Year

Sept. 1980

Expansion of microcomputers with Title IV-B funds to junior and senior high school resource rooms.

Sept. 1980

Purchase of two Hewlett-Packard minicomputers and 70 terminals for computer-managed-instruction.

April 1981

Purchase of printers and disk drives for microcomputers in junior high school resource rooms for word processing.

1981-1982 Academic Year

Sept. 1981

Project APT: Programming course for elementary gifted handicapped students.

Sept. 1981

Adult education courses offered in programming on microcomputers.

March 1982

Inservice sessions for district administrators on word processing, Big Trak, LOGO, and Hewlett Packard system.

1982-1983 Academic Year

Sept. 1982

District inservice for elementary and secondary principals on computer awareness.

Sept. 1982

Purchase of microcomputers for computer labs in the two junior high schools.

Sept. 1982

Expansion of Project APT to programming course for intermediate, self-contained classroom in special education.

Sept. 1982

Word processing pilot program in one elementary school.

Sept. 1982

Huntington/Commack Collaborative Education Software project established to evaluate commercial programs.

II. FEATURES OF THE MICROCOMPUTERS

Introduction

Of the entire array of computers and microcomputers in the Commack School District, 57 microcomputers are the focus of this case study. These include the 55 Commodore PET microcomputers, equipped with either cassette players or disk drives and seven Diablo MX-100 printers. The other two microcomputers are one Texas Instrument and one Apple II-Plus.

Most of the 55 Commodore PETs are located in the resource rooms of all the elementary and secondary schools. In addition, each elementary school has several mobile Commodore PETs, located on carts, that are rotated among all the classrooms on a pre-set schedule. One of the elementary schools has a lab that contains three Commodore PETs.

Both junior high schools have computer labs equipped with eight to ten Commodore PET microcomputers in their math departments. Two Commodore PETs are located in the district's gifted/talented program, which is housed at the central administration building.

The Texas Instrument unit is located in the elementary computer lab. The Apple II-Plus microcomputer is located in one of the elementary school resource rooms.

Microcomputer use in the elementary school resource rooms is by special education, compensatory education, and remedial students. The students are sent to the resource rooms by their classroom teachers on an individual basis throughout the school day, for basic skills, word processing, and programming instruction. The computers are in constant use, and there is even a before-school and after-school schedule in most resource rooms for additional computer time.

The mobile microcomputers in the elementary schools are scheduled for one classroom for an entire day, so that each student has some access to a microcomputer on a regular basis. All kindergarten students have time each week to learn a primitive LOGO language, Big Trak. The two Commodore PETs in the district's gifted/talented program are utilized on a daily basis by students learning programming.

The Commodore PETs in the junior high and high school resource rooms are used in the same way as the elementary school resource rooms' microcomputers, and there is evidence of continuous use. In one junior high resource room, all of the students

are using the microcomputers for word processing and computer graphics. The computer labs in the junior high schools are utilized by all the math students for a ten-day computer literacy course.

One of the distinctive features of microcomputer use in the district is the substantial assistance given to students by other teachers and specialists--e.g., parent volunteers, teacher assistants, or the student intern. In all the special education applications, there was at least one adult working with every two or three students, talking with the student and reinforcing the information being presented by the microcomputer. Such intensive use of human instruction seems to be an important way of enriching the microcomputer learning experience.

Management of the Microcomputers

The Commack School District has been reducing its staff over the past few years in response to its declining enrollment. As this has happened, more general positions, such as the director of student services, have emerged and replaced more specialized positions. Thus, the director of student services is responsible for functions related to special education as well as federal funds, compensatory education, pupil personnel services, curriculum development, and computer programs. Before the administrative consolidation, his position had been limited to being the director of pupil personnel services. The director of student services reports directly to the Superintendent regarding his special education and other activities. He is responsible, in conjunction with the principals, for supervising the special education teachers. In addition, the special education psychologist, a lead reading teacher, and the computer curriculum specialist all report directly to him.

With regard to the management of the microcomputers, there are two key positions--the director of student services and the computer curriculum specialist--who jointly make the decisions to purchase and locate the microcomputers, and to initiate specific funding applications. Once the hardware is determined and sources of funding are secured, the two then get the Superintendent's approval. After the microcomputers are installed, the computer curriculum specialist, who is responsible for the development of new computer programs in the district, usually coordinates the use of the microcomputers and monitors new applications with the teachers on an informal basis.

There has been some isolated adoption of microcomputers when a principal, in conjunction with the PTA, has decided to purchase units for a school. However, because the computer curriculum specialist is so involved in the computer use in the schools, she is usually consulted on these purchases and is involved in the ensuing implementation.

Illustrative Applications

To provide an idea of how the microcomputers are being used in Commack's schools, two illustrative applications are described below.

Computer Education in Elementary Schools. Kindergarten students in the district are approaching problem-solving tasks by using a robot-like tank (Big Trak) that can be programmed to follow directions. It is part of an early-learning research project to teach space and shape concepts in preparation for learning more abstract concepts with the LOGO language on a microcomputer. Specific learning objectives have been established for this early childhood computer education project and each student is monitored according to the number of attempts needed to master each skill. Students are asked to program the robot to solve simple problems like moving a certain distance or maneuvering through a maze.

The kindergarten students proceed to microcomputers and the LOGO language in the first grade. Learning LOGO requires a transfer of learning from the concrete to the abstract by moving from a toy robot to the symbols on the microcomputer screen. First grade students are taught the concepts of space, angles, shapes, and grids using Turtle graphics. The computer activities present situations in which students have to analyze their thinking and develop problem-solving skills.

The Texas Instruments microcomputer in the elementary resource room is used to teach LOGO to the students. Students are sent individually to the resource room during a scheduled time each week for twenty minutes to receive instruction from either the computer intern or a trained parent volunteer. All of the first grade teachers will soon be trained in the curriculum developed for the LOGO program.

Computer Programming and Word Processing. Simple programming and word processing are being taught to special education and remedial students at one of the junior high schools. This application began three years ago when one Commodore PET was delivered to the resource room. Students started by using some typewriters in conjunction with a simple computer typing program to learn the keyboard and gain some facility in operating the computer. The next step involved learning to load and run some of the district-developed software programs in various skill areas. The students used different programs for drill and practice in math facts, spelling, and vocabulary, and for practicing eye-hand coordination and visual discrimination. The students were required to read directions independently and to demonstrate and explain programs to other students.

The microcomputer was used by students individually or in pairs on a rotating schedule. The number of students in the resource room varies at any given time but is usually around ten or twelve. Three special education teachers and one teacher assistant provide constant direction and individual instruction with the microcomputer.

When three additional Commodore PETS, equipped with disk drives and printers, were provided to the resource room, students wanted to do more than utilize the available software. With an added word processing capability, it was decided to produce a magazine containing stories and graphics. Each student planned a graphic design (rock bands, spaceships, names, cartoon characters, etc.) on graph paper that was transferred to the computer screen. Working in pairs, students entered their designs into the computer using a simple editing process. Students used the word processing program to write their stories and essays which they edited and printed for the final product.

III. ORGANIZATIONAL ISSUES

Centralization and Decentralization

Any judgement regarding the degree of centralization or decentralization of the microcomputer system must be based on an aggregation of several characteristics: the initial decision to adopt, the decisions to assign and locate the microcomputers, the degree of coordination in using the microcomputers, and the organization of the software resources.

The decision to adopt microcomputers in the district followed a one-year, pilot project with BOCES/LIRICS system (an on-line, time-sharing terminal instructional system) at an elementary school. The project, funded under Title IV-C, was known as Project CAL (Computer Accelerated Learning), and was aimed at showing the feasibility of using computers for elementary level instruction.

The decision to adopt the initial set of microcomputers seems to have been made at three levels within the district, but with the degree of initiative unclear among the levels. Among the principals, the principal of one elementary school had been encouraging the use of computers, especially in initiating and supporting Project CAL. This initial involvement on the principal's part led to recommendations to the Superintendent and the other principals. At the teaching level, Project CAL had been directed by an elementary special education teacher, and she was instrumental in initiating the use of microcomputers. (Later, she took on the role as the district's computer curriculum specialist.) At the district level, the decision to acquire the first set of microcomputers, using Title IV-B funds, had to have been approved by the Superintendent, who had also approved the pilot project.

The first ten microcomputers (Commodore PETs) were each assigned to one of the elementary schools in the district. Coordination of the system was monitored in terms of scheduling and use during the first year by the computer curriculum specialist. Initially, at least one staff member at each school was trained in computer awareness and the operation of the microcomputers. (By now, of course, many of the teachers have had the opportunity to participate in seven-week computer courses on computer awareness and programming.) Beyond the initial training and some intensive consultation where necessary, the coordination has been less obtrusive. For instance, there is no single collection of software or any software catalogue except for the list of the district's own developed programs--which, however, have been systematically duplicated for every

microcomputer unit. Finally, maintenance problems have been rare, so little coordination has been needed.

This pattern of implementation appears to have been followed in subsequent purchases of microcomputers in the district. The potential uses of new computers are first identified by the computer curriculum specialist for the district, and the appropriate hardware is determined and approved in consultation with the director of student services. In the past, the two have gotten the Superintendent to apply for funding for the purchases, and simply had the microcomputers delivered to the appropriate schools.

Because decisions to purchase, to locate the microcomputers, and to initiate specific applications all tend to be made by the computer curriculum specialist and the director of student services, one would regard the system as generally being centralized.

The centralized characterization is reinforced by the functions of these persons with regard to related systems--e.g., the Hewlett-Packard instructional system and the microcomputers used at the central office for administrative functions--as well as other educational technology in the schools. All of these uses appear to be orchestrated in a manner that points to central decisionmaking and planning.

However, the system does have certain decentralized features. This is mainly due to the fact that the district staff is lean, and much control over school activities is at the building level. Thus, active PTAs can and have sponsored the purchase of new microcomputers, and their use may not necessarily be coordinated by the district. Similarly, the specific uses by teachers involve considerable discretion, which the district attempts to promote rather than suppress.

Special and Regular Education Interaction

Microcomputer use began in the district as the result of an interest by an elementary special education teacher and a principal. Because both persons were intensely interested and oriented toward the education of students with special needs, the original set of ten microcomputers was assigned to the resource room in each elementary school. Thus, the microcomputer system in Commack began as a system mainly oriented toward special education.

However, it should also be noted that the resource rooms are not limited to special education students. Compensatory education students as well as students needing remedial work are

also assigned to resource rooms. In this sense, the micro-computer system has never been limited solely to use by special education students.

Microcomputer utilization continues to be oriented primarily toward special education, as does the Hewlett-Packard mini-computer system (which again is used by special education as well as compensatory education and remedial students). At the teaching level, the special education and regular education staffs tend to be separate, and the special education teachers have probably dealt more frequently with microcomputers than have regular education teachers.

However, microcomputers are gradually being used by regular education students and teachers. The director of student services and the computer curriculum specialist (which is a position held by the special education teacher originally involved in microcomputers) have looked at funding sources and potential applications from both special and regular education points of view. Similarly, when an application such as word processing appears to be successful for special education situations, the same application is considered for use in regular education. Thus, as the district has acquired and installed new microcomputers, it has done so in the interest of both special and regular education students. In this sense, there has been an increased integration of special education with regular education.

During the past year, for instance, sufficient numbers of microcomputers have finally been installed so that one educational goal is to have every student able to have some microcomputer time during the school year.

Administrative and Instructional Applications

Each set of microcomputers that has been acquired has been designated for specific uses, not all of them the same. The designations depend upon the prior experiences of the computer curriculum specialist, who tests new types of instructional applications each year. When the applications appear successful in her own school, she recommends them for broader utilization throughout the district.

The set of applications for the initial purchase of ten Commodore PETs was related to computer-assisted instruction for elementary school students. The microcomputers were assigned to the resource room of each elementary school, and were used for individualized instruction, ranging from computer awareness to programming. Later, applications that became prominent with further purchases included word processing, graphics, computer

awareness for a larger portion of the student body, and the expansion of the original CAI applications at both the elementary and secondary level. It must be noted, however, that the Commodore PET microcomputers are not used for computer-managed instruction, which is carried out on the two Hewlett-Packard mini-computers and their accompanying 70 on-line terminals.

When considerably different applications have emerged, different computers have been acquired. Thus, the initiation of a project teaching LOGO language required the acquisition of a Texas Instruments microcomputer. Where administrative applications have emerged, this same pattern has been followed, and thus the instructional and administrative applications exist on different microcomputer systems. (For the administrative applications, two Commodore 8032s were purchased for use at the central office, for maintaining special education and gifted/talented student enrollment projections, inventories, mailing lists, general word processing, budget development, and personnel records.)

The district made a deliberate decision to separate the instructional and administrative systems. Several reasons were given by the director of student services for such a clear demarcation, including the awareness that:

- in a mixed system, administrative functions gradually displace instructional ones;
- a mixed system creates security problems because students may try to gain access to the administrative data;
- no single type of hardware necessarily serves both the instructional and administrative applications in the most efficient manner.

Other than the purchase of the Commodore 8032 microcomputers, all resources have been allocated toward the acquisition of microcomputers for instructional purposes. There are no administrative applications at the school-building level. Thus, all the microcomputers in our case study have been dedicated to instructional uses only.

Training

Initially, when the first set of ten microcomputers was introduced into the elementary schools, one resource staff member was trained in each school. The computer curriculum specialist assigned the microcomputers to each site, along with

copies of the district's software programs, and provided some introductory orientation and training in computer operations. The progress of each resource room's microcomputer use was then monitored in an informal manner to insure continued support and smooth implementation.

With the introduction of microcomputers into the secondary school resource rooms and subsequent expansion into the elementary schools, the need for staff training increased substantially. As a result, the first inservice course on computer awareness was offered in the spring of 1980. The course covered: 1) basic knowledge and operation of the computer, 2) integration of computer use into the curriculum, and 3) introductory programming skills to enable teachers to modify or create instructional programs.

Later, additional courses were developed and provided to interested staff in BASIC programming, advanced BASIC programming, word processing, and computer graphics. The courses are usually taught by the computer curriculum specialist, several other teachers in the district, and outside computer experts. All of the courses are offered on a regular basis throughout each academic year and consist of seven sessions for a total of 14 hours. Approximately 250 teachers, teacher assistants, and parent volunteers have completed one or more of the courses.

In addition, a workshop on computer awareness was given in September 1982, to the elementary and secondary principals to increase their knowledge and active participation in their schools' computer programs. Principals also have been encouraged to attend the district's inservice courses. In the spring of 1982, four workshops on different microcomputer applications in the schools were conducted for the district's administrators to develop their awareness and support.

The Commack School District also offers adult education classes in programming on microcomputers. Many parents who act as computer assistants in the resource rooms have taken the classes. Other parent volunteers have attended the afternoon workshops on computer awareness at each school as part of the assistance program.

Emerging Roles

The only new role that has been formally created for the district is one of computer curriculum specialist, which occurred in the fall of 1979. The position is held by the elementary special education teacher who initiated the use of microcomputers in Commack. Working out of a computer lab in one of the elementary schools, she coordinates the district-wide

computer program. Under the guidance of the director of student services, she is responsible for all the computer programs in the district and has been instrumental in introducing new computer projects and applications in the schools.

As computer curriculum specialist, she is involved with other district administrators in determining computer purchases, allocations, and possible applications. She coordinates the actual installation of new microcomputers and provides introductory training to staff members. For new applications, the computer curriculum specialist usually monitors the implementation process on an informal basis for the first year.

In this position, she has organized a project to review and evaluate software and has been instrumental in the development of new educational software programs in Commack. In addition, she was involved in the creation of a regional K-12 Computer Committee to develop a comprehensive computer education curriculum and implementation plan.

Apart from the computer curriculum specialist, there are computer assistant roles that have emerged to support the computer programs. Each resource room is staffed with assistants to work with students individually at the microcomputers. Many parent volunteers have been trained to serve in this capacity in the resource rooms. High school computer science students have been bussed to the elementary schools to act as computer assistants and even as programming instructors for the gifted students. An internship position has been created for a graduate student to assist in several schools in teaching programming to gifted/talented students.

HOPKINS SCHOOL DISTRICT NUMBER 270
Hopkins, Minnesota

Case Study Report

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I. SUMMARY NARRATIVE AND CHRONOLOGY

The School District

Hopkins School District Number 270 is located in Hopkins, Minnesota, approximately 20 miles west of the metropolitan area of Minneapolis. The school district covers about 30 square miles. There are a wide variety of businesses including merchandising, tourism, and light industry in this suburban area. Several high technology corporations such as Control Data Corporation and Honeywell are located in Hopkins.

The school district serves a residential population of 52,825 from seven municipalities, with a student population of 6,927 (about 97 percent white) during the 1982-1983 academic year. There are six elementary schools, two junior high schools, and one high school. The district offices are located in a former high school complex, which was closed in 1982 due to consolidation, but is now utilized by the city as a community center.

Educational services for the 800 special education students in the district are provided by the special services department. The department offers a full range of special education services, including programs for educable mentally retarded, emotionally disturbed, multiply handicapped, students with speech and language problems, and students with "special learning and behavior problems." Vocational/technical programs are offered to special education students through a teaming arrangement with an adjacent school district. The special services department also provides comprehensive child study services to the community. The child study team in Hopkins consists of the classroom teacher, the building principal, a counselor, a psychologist, a speech and language pathologist, a resource teacher, and other optional building staff members.

The director of special services is responsible for the administration of the special education program. The special education staff consists of a supervisor of special education, special education building chairpersons at the secondary schools, a department lead teacher for the elementary schools, and 31 special education teachers. The special education staff is assisted by 15 counselors, 14 social workers, 6 psychologists, 8 speech and language pathologists, and a variety of other staff, including a preschool screening specialist, an occupational therapist, and an adaptive physical education teacher.

Computers have been used in educational programs in Hopkins since the early 1960's. Initial instructional applications

utilized a district mainframe computer. With the advent of microcomputers in the late seventies, the district planned and implemented district-wide use of microcomputers for instructional and some administrative applications.

Overview of the Microcomputers Studied

There are 120 microcomputers in use in the district. Nine of these units were purchased with special education funds, but district policy is that all equipment be utilized by the entire population and the equipment is not departmentalized. Nine units are in administrative offices, 47 are in classrooms, and 64 are in media centers. Eighteen units are at the district central complex, 38 are in the high school, 30 are in the junior high schools, and 34 are in the elementary schools. Across the district, the microcomputers are used for a wide variety of purposes, including:

- computer-assisted instruction (CAI) including drill-and-practice, simulations, tutorials, and problem solving;
- computer literacy and computer programming;
- business education course (word processing, accounting, keyboarding, etc.);
- instructional management;
- administrative applications (teacher gradebook, attendance, class scheduling);
- music composition with electronic keyboards in elementary music classes; and
- library/media operations.

Much of the software for the microcomputers is produced locally. Additional software is acquired from the Minnesota Educational Computer Consortium (MECC), the Total Information Educational Systems (TIES), and commercial vendors.

Since 1967, Hopkins has worked with 60 other school districts to provide data processing services through TIES. As microcomputers have become available in member districts, TIES has reorganized its services to accommodate the decreasing mainframe needs and the increasing needs for microcomputer support.

The school district has also developed a proposal for the 1983-1984 school year to establish "The School of Tomorrow Today." The plan calls for a demonstration learning center/classroom in an elementary school. The purpose of this center would be to establish a learning environment, incorporating the latest technological advances in curriculum programs, instructional methods, and teacher-student interaction skills.

Chronology

Computers were used in the educational program since the early 1960's. However, microcomputers were not introduced until 1978. In that year, the Hopkins evaluation center purchased a TRS-80 microcomputer. In November 1978, a technology task force for the district was established. The committee members were selected because of their interest in the field, and to represent a variety of district programs, although not all curriculum areas or all district school buildings were initially represented.

The first meeting of the task force was held with similar committees from two neighboring school districts. At this meeting, demonstrations were given on several types of computer hardware. Three microcomputers--Radio Shack TRS-80, Apple II, and Commodore PET--were available for examination.

At the next meeting of the Hopkins task force, the members developed a list of instructional and management needs. A third task force meeting provided the opportunity for members to hear a report on the implementation of a Commodore PET microcomputer in another school district. The committee developed a position paper that ultimately made the following recommendations:

- that the district curriculum council be responsible for final decisions involving the implementation of microcomputers and other technologies;
- that a person be made available at the district level to assist building personnel in implementation and utilization; and
- that a person be appointed in each school building to be responsible for the implementation, maintenance, and development of technology.

Other recommendations concerned the selection and distribution of microcomputers and related equipment, as well as a recommendation that the district continue to be involved in existing consortiums (TIES, MECC) to share computer programs and

materials.

The task force requested and obtained district money to purchase 17 Apple II microcomputers in 1979. Since that time, additional microcomputers have been purchased with building funds, Title IV-B, Special Projects funds, and money raised by the parent teacher organizations. The first 17 microcomputers were placed in a building lounge for the first half of the school year and, in December 1979, distributed to other schools.

In subsequent years microcomputer use has expanded throughout the district. In 1980-1981, 34 Apples were added; in 1981-1982, 17 more; and in 1982-1983, 25 Apples, plus 20 additional printers. Currently there are 117 Apple microcomputers, 3 Texas Instruments microcomputers, and a wide variety of peripherals in the district. Most microcomputers are equipped with disk drives and color monitors. Of these, 103 units are used mostly for instructional applications; 17 for administrative.

A wide variety of training opportunities have accompanied the growth of microcomputers in Hopkins. Inservice course offerings have included: "Advanced Apple II Computer Programming," "Beginning BASIC for the Apple II," "Computer Independent Study," "Intermediate BASIC Computing," and "Use of the Computer with Cooperative Learning."

Hopkins has been the site of several innovative projects advancing the use of microcomputers. CAM (Comprehensive Achievement Monitoring) an instructional management tool to monitor student progress, has been used since the early 1970's and was initially based on a mainframe computer. In 1978 the district made CAM available for microcomputers.

Project ASSIST, (Automated Special Services and Student Tracking) was implemented in 1981, with a Title IV-C grant. This project uses microcomputers to manage the data essential to various special education reports and records. It also keeps track of special services personnel and budget information.

In the spring of 1982, Hopkins was selected as a National Diffusion Network Lighthouse Project. This project allows the staff to share with other districts, and has been refunded for the 1983-1984 academic year.

The major events in the history of microcomputer implementation in the Hopkins School District are presented in Table 1.

Table 1: Chronology of Implementation

Hopkins School
District
Number 270

Date Month/Year	Event
<u>1978-1979 Academic Year</u>	
Fall 1978	Evaluation Center purchased one TRS-80 microcomputer.
Nov. 1978	Technology task force established to recommend district guidelines regarding technology implementation. Orientation for planning group provided.
Fall 1978	District makes CAM available for microcomputers.
Dec. 1978	District-sponsored inservice training on calculators and microcomputers.
<u>1979-1980 Academic Year</u>	
Sept. 1979	Purchased 17 Apple II microcomputers with district funds.
Dec. 1979	17 microcomputers distributed to classrooms and media centers in the schools.
Dec. 1979	District initiates series of inservice training courses on BASIC programming.
Summer 1980	Three positions established: data processing and dissemination specialist, programmer analyst consultant, and instructional computer consultant.
<u>1980-1981 Academic Year</u>	
Fall 1980	Building purchases totaling 34 Apple II microcomputers.

March 1981

Inservice training on "cooperative learning" with microcomputers.

1981-1982 Academic Year

Fall 1981

Building purchases totaling 17 Apple II microcomputers.

District implements Project ASSIST, initially funded through Title IV-C.

Spring 1982

Hopkins School District selected as National Diffusion Network Lighthouse Project.

Summer 1982

Part-time position for CAM micro-computer implementation associate established.

1982-1983 Academic Year

Fall 1982

Building purchases totaling 25 Apple II-Plus units as well as 20 additional printers.

Jan. 1983

Technology task force reconvened to review district goals regarding technology implementation.

II. FEATURES OF THE MICROCOMPUTERS

Introduction

There are currently 117 Apple II microcomputers and three Texas Instruments units in the Hopkins School District. Eighty percent of the microcomputers have color monitors, 20 percent of the microcomputers have dual disk drives, and 20 percent have printers. Additional hardware in the district includes an electronic keyboard for music composition, a voice synthesizer, and a graphics tablet.

There are 34 Apple microcomputers distributed to six elementary schools. The microcomputers are in media centers and can be checked out to individual classrooms. The media specialist at each school is responsible for the equipment and for cataloging the software. The child study secretaries use the microcomputers for ASSIST applications. Three microcomputers are located in elementary school administrative offices.

There are 15 Apple II microcomputers at each of the two junior high schools, placed in classrooms and in the media centers. Most instructional applications use the MECC software. Some students write courseware at teachers' requests as part of their independent study projects.

At the high school, nine Apple II microcomputers are used for upper level math and programming; seven in business education for keyboarding, accounting, and bookkeeping; several in the media center and science classrooms; and two units in the office for budget and accounting work. Daily announcements are assembled on a microcomputer in the office and are made available to students on monitors located throughout the building.

The microcomputers in media centers and classrooms are used almost constantly during the school day, including the lunch periods. The units in the administrative offices are reserved for administrative use and generally not available to students. The microcomputers are available for teachers, parents, and administrators to check out during weekends, holidays, and summer vacation.

There are 17 microcomputers at the district building. Nine of the microcomputers are divided among the following offices: business, special services, food services, community services, building and grounds, and district media center. They are used for one or more of the following applications: budget, accounting, food inventory, meal planning, Project ASSIST, word

processing, energy audit, and media inventory. Eight of the microcomputers in the evaluation center are used for developing instructional and administrative software. (The Software produced at the evaluation center has been purchased by more than 100 school districts around the country). The microcomputers are also used for instructional support and training.

Management of the Microcomputers

Media specialists within each school are responsible for the implementation and management of the microcomputers. The district's instructional computer consultant provides training to media specialists, teachers, and parents. He assists the media specialists in maintenance and use of computers. He also coordinates compilation of appropriate software.

In the spring of 1983, the evaluation center began receiving all purchase requests (hardware and software) by the schools. New acquisitions are received at the evaluation center for inventory and inspection and then sent to the school that had purchased the equipment. Authority for the allocation of microcomputers within schools, and for the nature and extent of applications in schools, is delegated to the building principals.

Illustrative Applications

To provide an idea of how the microcomputers are being used in the Hopkins schools, three illustrative applications are described below.

Special Education Database Management--Project ASSIST. This administrative application makes it possible to review seniority dates, to publish staff directories by department or building, and to review salary and funding sources. Other components contain student demographic data and educational records.

The primary users of this application are the child study secretaries in each building, and the special services secretary at the district office, the director of special services, and the coordinator of special education. This project involves 11 Apple II microcomputers on a part-time basis, which are located in media centers or offices of each school. Backup disks for each file and a 132-column printer for report generation are also used. Software for Project ASSIST includes three locally-developed programs and a commercial product, D.B. Master Data Base Management Software.

Project ASSIST has enhanced the district's ability to maintain all necessary district, state and federal information. All participants in the project have expressed satisfaction with its implementation and outcome. In particular, the director of special services and the coordinator of special education reported that its major impact has been in reducing the amount of time now required for special education administrative tasks.

Introductory Computer Programming/LOGO. The instructional computer consultant from the evaluation center and the cooperative learning coordinator are team-teaching with a fifth grade teacher. Her students are learning LOGO in the context of a "cooperative learning model."

The teacher introduces the lesson and uses a student to help demonstrate by playing "turtle." The other students give the turtle/student the correct commands that help him or her walk in a square. The commands are then translated into the special (but similar) language commands that are acceptable in LOGO graphics.

After this demonstration, the class is divided into work groups of four students each, who then implement this lesson on the microcomputers. Specific tasks are assigned to the children. Each student has a responsibility to help the group work effectively and productively. Roles that are delegated include chairperson, recorder, and "encourager." Each group produces a square (or other figure) using the "turtle commands." After each group has completed the task, the students return to their assigned workspaces and another group uses the microcomputer. Each group provides feedback to individual group members as to how well they assumed their assigned roles.

Computer-Assisted Instruction in a Special Education Resource Room. Two teachers in an elementary resource room received a microcomputer during 1980-81, for use with approximately 30 special education students. The microcomputer is an Apple II with a disk drive and printer, and is used primarily for math and language arts instruction. There is Milliken math and language arts, MECC, and Houghton Mifflin Wordwise software available in the room, and additional software available from the media center.

The teachers have decided that students should use the computer "as needed" and have worked out a system of student negotiation for scheduling use. The teachers believe that the negotiation technique encourages socialization in the classroom. Typically, if one student is working on the microcomputer, a student needing the unit must negotiate for a stopping time with the student already using the unit. The second student must then sign up for the amount of time needed to complete his/her

assignment.

Informal schedules are kept for lunch hour use of the microcomputer. Students are also assigned a day on which they can bring a friend in during lunch hour. This "reverse mainstreaming" technique often brings regular education students into the special education classroom.

III. ORGANIZATIONAL ISSUES

Centralization and Decentralization

The microcomputers in the Hopkins School District are characterized by both centralized and decentralized features. Purchasing decisions for both software and hardware are made at the building level. However, the district's evaluation center has emerged as a "regulatory agency," as it must approve all purchases. This provides quality control by the experts employed there and also serves to monitor the technological developments in the district.

Administrative applications, including CAM, MMS, and Project ASSIST, are coordinated at the district level and reports are pooled into a central data base for reporting. Nevertheless, even though administrative applications are coordinated at the district office, the degree of implementation at each school remains a building decision. The same philosophy prevails with instructional applications.

A district-organized technology task force was formed in 1979 to plan and coordinate the initial purchase of 17 microcomputers. In January, 1983, the task force was reconvened to check progress in the district and to see if the original guidelines were still applicable. A new position paper is now being prepared to serve as a blue-print for future developments. As for software, curriculum groups at the building level meet and discuss software needs. These groups consider suggestions from the evaluation center staff, preview materials, and make the final purchase decisions, with approval by the principal.

The district also uses the services of TIES for mainframe computer-supported budget and accounting applications. There has recently been a reorganization of the TIES services to incorporate microcomputer technology and, therefore, conflict between mainframe and microcomputer users has been avoided.

Special and Regular Education

The introduction of microcomputers has not had any effect on the working relationships between special and regular education teachers beyond what any other building-wide project might entail. Good working relationships are reported and special education teachers typically spend as much as one period per day in regular education classrooms where they team-teach and also assist mainstreamed students.

The media specialist in each school has been responsible for implementing and coordinating the local microcomputers. Special education teachers' involvement has not differed from that of regular education teachers. Each classroom has scheduled times for using the microcomputers, whether the classrooms are special or regular education.

Several special education classrooms, however, have their own microcomputers. Arrangements can be made for regular education students to schedule use, if this is important to an individual student's program. The term "reverse mainstreaming" was used on several occasions to explain the opportunity that a special education student has to invite a regular education friend to use the special education computer on a specified day during the lunch hour.

One special education teacher, who is the cooperative learning coordinator, demonstrates "cooperative learning models" to elementary teachers in several schools, in a teaming arrangement with the district instructional computer consultant. Together, they present inservice training and make classroom presentations. They instruct teachers in the use of the microcomputer for problem-solving activities in which children learn how to work cooperatively in groups.

The project is sponsored by the federal government (SEP/DE), and Hopkins is one of three district regional centers in Minnesota. One regular education teacher commented that the special education department provided "new blood" and an innovative spirit to the district.

Administrative and Instructional Applications

Presently, there are 103 microcomputers primarily used for instructional purposes and 17 primarily for administrative purposes. An example of the shared use of microcomputers--between administrative and instructional applications--occurs in Project ASSIST. For some schools, the district evaluation center only provided double disk drives for microcomputers already allocated to the schools' media centers. (Two disk drives are required for Project ASSIST's administrative applications.) In these buildings, the child study secretaries are scheduled to use the available units part of the day for the Project ASSIST application; during other periods of the day the equipment remains available for instructional applications. In each case, the scheduling and extent of administrative uses are determined by the building principals.

There is no indication of competition for funds between instructional and administrative applications. The district-wide committees on technology applications have mostly emphasized the instructional needs of students and staff. Needs of particular administrators have not been addressed. The committees believe that the district must work to help students master technology as a tool and must provide teachers with the support necessary to do so. The district goal is to support, rather than to direct, microcomputer applications.

The present instructional and administrative applications in Hopkins complement rather than compete with one another. The following administrative and management system applications have been developed and implemented at Hopkins during the past three years: accounting systems, food service inventory systems, daily attendance programs, test scoring packages, instructional management systems (CAM and Mastery Management), and a special education tracking system (ASSIST). The evaluation center staff have supported these administrative applications, as well as the development of instructional applications, the review of commercial software packages, and the production of catalogs which are available to staff members with up-to-date information on materials for classroom use.

Training

There have been 28 district-wide inservice training programs on nine different computer topics. In addition, the instructional computer consultant has conducted building-level training and classroom demonstrations, together with the cooperative learning model teacher. Adult education classes have also been available for parents and their children. Summer school classes also provide microcomputer experiences for students.

The district provided inservice training to members of the first technology task force--both prior to and during the time they served on this committee which led to the first district purchases of microcomputers in 1979. All staff have been given the opportunity to receive training. The first microcomputers in the district were initially placed in teachers' lounges for half a year. Teachers participating in any of the district training can receive either a stipend or one "Hopkins Board Credit" which is added to their salary schedule.

The child study secretaries working with Project ASSIST meet monthly for training and "trouble-shooting" sessions. They have also received individual instruction and assistance in entering child data during the initial implementation of the

application. There were no indications that microcomputers were being underused or staff were experiencing difficulties that could be attributed to lack of training opportunities.

Emerging Roles

The media specialists in each school are responsible for implementing the microcomputers. In at least one elementary school, the media specialist is requesting a computer lab aide because the program has grown beyond what she and her present staff can handle without sacrificing other learning programs. The computer lab aide would be a full-time position with responsibilities for coordinating daily activities in the lab. This would include acquisition and maintenance of both hardware and software.

Presently, the district has three full-time and one part-time, district-level computer support positions. Three positions were established in the summer of 1980:

1. Data processing and dissemination specialist--responsibilities include implementation and operation of the TIES management information and instruction systems, as well as coordination and development of management applications using the microcomputers.
2. Programmer analyst consultant--responsibilities include development of microcomputer software for both instructional and management applications.
3. Instructional computer consultant--responsibilities include providing inservice training sessions for teachers, media specialists, and parents, assisting media specialists in the maintenance and use of the microcomputers, coordinating compilations of appropriate software; and, with the programmer, identifying software needs. He also assists in the review and revision of the district's computer curriculum.

The fourth position, was established in the summer of 1982:

4. CAM microcomputer implementation associate--this is a part-time position. District responsibilities include coordination of junior high level CAM use and test score processing; assistance in classroom implementation of microcomputers, particularly at the junior high level. Additional assignments included training and the development of materials.

MINUTEMAN REGIONAL VOCATIONAL TECHNICAL SCHOOL DISTRICT
Lexington, Massachusetts

Case Study Report

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The authors are grateful to Dr. Ron Fitzgerald, Superintendent, for granting permission for the Minuteman Regional Vocational Technical School District to participate in the study. We would like to thank Earle Hancock, Microcomputer Master Teacher, for arranging the visit and assisting the research team on site. We also appreciate the many staff people and teachers who met with us and gave generously of their time to make our efforts successful.

I. SUMMARY NARRATIVE AND CHRONOLOGY

The School District

Minuteman Regional Vocational Technical School District is a one-building (secondary school) district, established in 1975 by agreement of 16 neighboring towns. The school is located on 65 acres of woods and fields in Lexington and Lincoln, ten miles west of Boston. Admission to the school is open to any student within its member towns and serves as an option to the general, local high schools.

Currently, 1252 students attend grades 9-12, earning a high school diploma and a technical certificate in one of 25 occupational areas. The school program operates on a "week about" schedule, in which one full week is spent in academic subjects and the following week in a lab or shop. Thus, academic and vocational weeks are alternated throughout the school year.

Special education services are provided to 450 of these students. Such students are admitted to the school if they possess pre-vocational academic skills and can function in vocational training. The special education students are assigned to a resource teacher for educational support and guidance.

The special education program has a director of special education services who reports directly to the Superintendent. Within the special education division are ten resource teachers, a school psychologist, a social worker, a speech therapist, an occupational therapist, and a job placement counselor.

The vocational-technical programs are organized into nine clusters: building trades, commercial services, electronics, graphics, health services, metal fabrication, power mechanics, distributive education/child care, and technology. Each cluster represents several departments focusing on a particular trade or skill area, with required courses for each grade level. Students gain practical experience in their vocational area through the shops and services operated by the school for the public, such as a restaurant, bakery, beauty salon, service station, child care center, and landscaping service. The academic areas covered are English, mathematics, science, social studies, business, language, physical education, and a few electives.

In many of the academic areas as well as the vocational-technical shops, microcomputers and on-line terminals can be seen in use by teachers and students. Minuteman has a total of 27 microcomputers, of which 22 are Apple II-Plus units and 5 are Zenith Heathkit models. In addition, the school has three Digi-

tal PDP-11 minicomputers with terminals for both administrative and instructional functions.

Overview of Microcomputers Studied

Of Minuteman's 22 Apple II-Plus microcomputers, 15 are located in offices or individual classrooms and 7 are in a microcomputer center in the library. The microcomputers are used for a wide variety of purposes, mostly instructional rather than administrative, with over 100 pieces of software integrated into the curriculum. Examples of microcomputer use are:

- In science, microcomputer programs are used for tutorial instruction in chemistry, biology, and physics. Students in basic science receive reading and spelling instruction related to their coursework on the microcomputer.
- Electronics students learn to write BASIC and Pascal programs on the microcomputer, and also receive CAI in math. Some students are learning to use Data Base Management software, while others create games using graphics.
- The microcomputer center provides basic skill instruction to any student in areas such as math, spelling, grammar, reading, and social studies. The microcomputers are also used to train all freshman students in computer use and some senior students in basic programming.
- The culinary arts department uses a microcomputer to operate a daily, shop-inventory-control program for the student-run bakery.
- A joint vocational shops project, "Super Insulated House" is underway, combining the student expertise of the instrumentation department in using the microcomputers for environmental monitoring and control and the skills of the building trades department for construction.

In addition, the school's staff developed microcomputer-based lessons in spelling, vocabulary, literature, and history, to assist students in their academic courses.

Administrative uses of the microcomputer include:

- capital inventory control for each department;
- staff attendance records;
- student test data records; and
- some word processing.

Finally, the Superintendent uses his microcomputer for financial planning and simulations for contract negotiations. The microcomputer also provides data and graphics for the Superintendent's work with public hearings and finance committees.

Chronology

It was the Superintendent who first brought the idea of microcomputer use into the school in the beginning of 1980. He viewed the new technology as an invaluable teaching tool that "successfully combined patience with interactive learning." The interest of other teachers was solicited through a note posted by the Superintendent. Within several weeks, a committee of staff members was formed to investigate the use of microcomputers at other schools and to make recommendations for purchasing hardware.

By the late fall of 1980, nine Apple II-Plus microcomputers and software had been purchased, primarily with Occupational Education Entitlement funds (P.L. 94-482), and 60 staff members completed inservice training on microcomputer operations. The position of microcomputer master teacher was created by the Superintendent to act as a resource to the new users. In addition, several teachers were given the opportunity to develop their own programs over the summer.

The first microcomputers were allocated to the staff members who had shown the most interest and were likely to have success with implementation. However, the innovation was not mandated by the Superintendent, nor were any departments pressured to adopt microcomputers. In distributing the first units, the Superintendent also favored both decentralized and centralized approaches. He wanted students to experience microcomputers in the context of their vocational or technical area and not just in a center or in a reading or math department. As a result, the units in the microcomputer center are considered the centralized part of the microcomputer system, and the units in the individual shops and classrooms represent the decentralized part.

In September of 1981, the Superintendent, in consultation with the microcomputer master teacher, purchased nine additional Apple II-Plus microcomputers. The microcomputer center expanded to accommodate seven units, and a teacher was assigned the position of microcomputer specialist to manage the center's activities. The school's software collection, purchased with library funds, was indexed and catalogued for a printed "Microcomputer Program Guide." Additional inservice training was provided by the microcomputer master teacher, to meet the growing interests and needs of the staff.

Decisions on the distribution of the new units again were made on the basis of a teacher demonstrating an ability to use the machine for either instructional or administrative purposes. A written plan for use is considered inadequate; the acceptable demonstration of need consists of running programs in the resource center, writing new software, or exhibiting new applications for others. Insufficient use of a unit is grounds for having a microcomputer removed, which has occurred once in the past. The Superintendent's attitude and involvement continues to be one of "I will provide the means to support the use of microcomputers, if you prove how to make use of them."

The major events in the implementation of microcomputers in Minuteman Regional Vocational Technical School are presented in Table 1.

Table 1: Chronology of Implementation

Minuteman
School
District

Date Month-Year	Event
<u>1979-1980 Academic Year</u>	
Dec. 1979	Superintendent saw microcomputers on a visit to California.
Jan. 1980	Committee of interested persons formed to recommend hardware.
June 1980	Purchased one TRS-80 and one Apple II-Plus, and software.
<u>1980-1981 Academic Year</u>	
Sept. 1980	Microcomputer duties allocated to one teacher.
Oct. 1980	First teacher training offered (15 hours).
Nov. 1980	Purchased nine Apple II-Plus and two printers; designed and built work stations.
April 1981	Purchased one Apple II-Plus.
June 1981	Five teachers paid over summer to develop software programs.
<u>1981-1982 Academic Year</u>	
Sept. 1981	Half time position of micro-computer master teacher created.
Sept. 1981	Purchased nine Apple II-Plus units and printers.
Sept. 1981	Set up microcomputer center in I.R.C. with four Apples and microcomputer specialist.

Nov. 1981

Printed "Microcomputer Guide."

1982-1983 Academic Year

Sept. 1982

Purchased one Apple II-Plus
and upgraded all microcomputers
to 64K.

Sept. 1982

Formalized computer orientation
program for all freshmen.

Sept. 1982

Purchased Corvus hard disk drive.

Nov. 1982

Purchased Cavri system and two
video cassettes.

Nov. 1982

Formed micro/mini computer co-
ordination committee.

II. FEATURES OF THE MICROCOMPUTERS

Introduction

Presently, there are 22 Apple II-Plus microcomputers in the school. Most of the units have color monitors, and several have double disk drives. There are eight dot matrix printers and one printer of letter quality. A few of the microcomputers are equipped with either a graphic drawing tablet, a light pen, or paddles for special applications.

The school has recently acquired a Corvus hard disk drive for a future software project, as well as a Cavri system interactive, video-cassette display.

Five vocational areas--culinary arts, machine shop, carpentry, distributive education, and instrumentation--each have a microcomputer located in their work space. The English department has one unit placed in a small workroom. In the science department, one microcomputer is moved around to different classrooms. There is one microcomputer in the developmental math lab. The guidance office has one unit, and the Superintendent has a unit in his office. The microcomputer office, which also functions as a resource room, has three of the microcomputer units and one printer. Seven of the units and two printers are in the microcomputer center, which is a section of the library/media center, and to which teachers can send their students for microcomputer use during class time.

Regarding the level of use, only estimates exist. It is believed that 80 of the 130 vocational and academic teachers use the microcomputers on a regular basis. Of the ten resource teachers (special education), six are said to use the microcomputers with their students in the microcomputer office or center. Among district personnel, the Superintendent is the only user, and none of the school administrators use microcomputers in their work.

According to the microcomputer master teacher, approximately half of the students (about 600) use the microcomputers on a regular basis in connection with their shop skills or academic learning. It is estimated that at least 50 percent (300) of these users are special education students. Furthermore, all freshmen students are given introductory training in computer literacy.

In terms of use, the microcomputer center, for example, averages 70 or more students per day. With its seven microcomputers, the center serves students from all the resource rooms

in addition to the overflow from several departments, including: math, carpentry, English, and electronics. The microcomputer specialist in charge says that it is rare to have a free microcomputer in the center during any period in a given day. The microcomputer in the developmental math lab is used by 140 special education students for 40 minutes once a week. Each department with a microcomputer has a similar schedule that suggests constant use.

Management of the Microcomputers

The Superintendent makes all final decisions about microcomputer purchases and budgets, with approval from the school board. These purchasing decisions are made in conjunction with the microcomputer master teacher, who prepares the appropriate estimates based on his experience with the district's needs. This master teacher is part of the special education staff, and thus has no formal organizational relationship to the vocational education staff. However, the master teacher acts in an informal manner to assure that all of the district's needs are satisfied.

Nevertheless, the lack of formal coordination means that other hardware decisions can be made independently of the microcomputer master teacher. This occurred recently when the vocational education staff acquired five Heathkit microcomputers for its electronics "cluster," without consulting the master teacher, but with the Superintendent's final approval. In summary, the master teacher reviews most purchases and coordinates the use of the Apple microcomputers, but the other microcomputers fall outside of his responsibilities.

Microcomputer software decisions are made in a different manner. The software purchases are made from existing library and departmental budgets for materials. Individual teachers may suggest software to be purchased, and these suggestions may then be reviewed by the resource center teacher, by the various departments, or by the microcomputer master teacher before a decision is made to purchase.

Maintenance decisions are made by the Superintendent and the microcomputer master teacher. In mid 1982-1983, the maintenance contract was discontinued (due to high cost), and the master teacher now personally performs any necessary maintenance.

Illustrative Applications

To provide an idea of how the microcomputers are being used

in Minuteman, three illustrative applications are described below.

Individualized Instruction--Special Education. In this application, three students work at a time in the microcomputer office, which also serves as a resource room for special education students.

Along two sides of the small room are three microcomputers with disk drives and one printer. A metal file cabinet contains a selection of software. One student may work on a math program of word problems that uses a game-like format. The emphasis is on whole-number operations as well as reading skills. The teacher indicates that the program is typical of most of the math drill-and-practice software used in building basic skills. Another student may have recently become interested in microcomputers and is spending his time learning the basic elements of programming. These students are part of a program for special education students that provides individualized instruction on microcomputers, with an additional emphasis on computer literacy. Students are selected for the program based on their resource teachers' recommendation and the learning objectives contained in their Individual Education Plans (IEPs). The program is taught by the microcomputer master teacher who also acts as a resource teacher for special education students.

The microcomputer master teacher says that at the beginning of his course none of the students could even operate a microcomputer. After he works with each of the 20 to 30 students for approximately 40 minutes (for eight weeks), the students can use "canned" software independently, and most of them can write simple programs. In accordance with the students IEP's, they use drill-and-practice programs, strategic games, and simulations to help develop academic skills, visual perception, and decision-making strategies.

Computer-Assisted Instruction in Science. In this application, each planet, one by one, is slowly drawn on the screen in a colorful display before the student. The orbits of the planets, the orbits of comets, and the planets' sizes in relation to the others also are brilliantly animated. This particular program, by Synergistic Software, is actually a mini-movie about the solar system, in which the student is given information on individual planets and their moons, about comets and asteroids, and other illustrations of complex orbital relationships.

Students usually work individually at the microcomputer with a program that corresponds to the curriculum material presented in class. The teachers first use this program as a demonstration to the entire class. The science department's

single microcomputer is on wheels, and can be moved from one classroom to the next. It is used at the front of the room for the entire classroom and moved into a quiet corner for individual use. Only the interested students continue using the program, once demonstrated, for both practice and reinforcement. The science teacher is adamant about no one being forced to use the microcomputer. However, some students who are absent or behind in their work are urged to use it.

The science teacher says that the microcomputer is popular with most of the students and can be found in use every day in the basic science class for special education students. Fifteen students attend the science class for a double period, so each student can use the microcomputer at least once a week for approximately 20 minutes.

Record Keeping System (C.M.I.). In this application, an English teacher, interested in the administrative uses of the microcomputer, has developed a record keeping system for the entire department. With the microcomputer master teacher's assistance, an existing computer program (P.F.S.) was adapted to code in various test scores pertinent to the curriculum.

The English teacher was responsible for the initial data entry on all the students in the fall of 1982. Once the system was established, she taught the other four English teachers how to enter and retrieve information. The actual records are utilized in a number of ways. Teachers can enter student identification numbers and receive a listing of each student's test scores and grades. Lists of students who have completed competency requirements can be searched and printed. Students who lack a specific skill or need certain courses can also be identified in the system.

This system replaces manual files on each student, kept by different teachers, that were not coordinated and that demanded unnecessary duplication. It is the first attempt at maintaining a central information file on testing in the school and is expected to be adopted by the math department next year.

Once a year, the records are printed, with the data disks being updated throughout the school year. The printing has created some problems because the English department's microcomputer is not equipped with a printer and time has to be scheduled on the printers in the microcomputer center and office. It is expected that a printer will soon be purchased because it is a major part of the application.

III. ORGANIZATIONAL ISSUES

Centralization and Decentralization

The microcomputers in Minuteman exemplify two different issues regarding centralization and decentralization. First, within the microcomputer system, there has been a deliberate attempt to mix centralized and decentralized patterns of leadership. On the one hand, the Superintendent and microcomputer master teacher have exercised strong, central control in determining the microcomputer acquisition patterns. On the other hand, teachers do not simply receive microcomputers for their classrooms, but must first demonstrate their ability to use and integrate the microcomputers in their classroom plans. Similarly, some microcomputers are located in centralized places (e.g., the media center), but other microcomputers are decentralized and located in individual classrooms.

Second, the centralization and decentralization issue is relevant outside of the microcomputer system. Thus, in addition to the 22 Apple II-Plus microcomputers, the district's computer center (an administrative unit) has three Digital PDP-11 minicomputers. These are replacements for two minicomputers that had been in operation through 1981-1982. Terminals to the minicomputer system are located in the data processing department (an instructional unit) and in the special education, guidance, nurse and dean's offices, serving three major groups of functions:

- student use: students in the data processing department of the electronics cluster have full use of one minicomputer, in conjunction with their computer lab (for programming and technician training);
- student information: all of the district's attendance, grade reports, warning lists, student medical information, student information system, special education student data, special education quarterly reports, and class scheduling are done by the minicomputers; and
- administration: the payroll, accounts payable, budget, and related records (including service to the Town of Lincoln) are done by the minicomputers.

These large and diverse functions have created constant overloading of the minicomputer system, especially because it relies on disk drives of limited capacity (RLO-2's), and as a result the system has frequent down-time. This problem was not as severe in previous years, because the disk drives in the older system had greater capacity.

The problem of down-time, coupled with tight schedules for access time, have led some minicomputer users to begin developing a preference for microcomputers. For example, the guidance office now uses a microcomputer in addition to the minicomputer terminal, for easier and more flexible management of certain student data and attendance records.

Originally, the minicomputer staff in the computer center had little or nothing to do with the microcomputer system. The microcomputer master teacher noted that, "the computer center along with the data processing department have realized, but only in the last few months, that the microcomputers are a power to be used." Also, this year, some need to coordinate has emerged over the acquisition of new equipment, such as a printer that needed to be compatible with both systems. Such needs have resulted in some initial collaborative efforts--e.g., the microcomputer master teacher and computer center director recently formed a "coordinating committee."

Special and Regular Education Interaction

Minuteman is a vocational-technical school and there is relatively little distinction between the special and regular education services. Special education students are mainstreamed into the entire program.

However, every special education student is assigned to a resource teacher for at least one academic period a day. More time is spent in the resource room, depending on a student's skill levels and ability to take the regular academic subjects. Special education students with poor reading and math skills are assigned to the developmental labs for remedial work. Overall, these distinctions have nevertheless not led to any clear differences regarding the use of microcomputers for special education as opposed to vocational education.

One characteristic worth reiterating, however, is that the microcomputers have largely been purchased with non-special education (i.e., Occupational Education) funds.

Administrative and Instructional Applications

This is not a major issue, even though a few administrative applications exist. In general, the microcomputers are dedicated to instructional applications, with the administrative uses having only recently emerged. The single major exception is the one microcomputer assigned to the Superintendent, who uses it for administrative purposes. (The dominance of the instructional applications was one reason for selecting this site in the first place.)

Training

The first microcomputer inservice training took place in the fall of 1980, after the school's first purchase of two microcomputers. The course was open to all staff members and ran for two hours, once a week after school, for a period of 15 weeks. Under the tutelage of the Superintendent and with assistance from the microcomputer master teacher and the hardware supplier, 60 teachers learned the rudiments of microcomputer use. The course covered system operation, evaluation and selection of software, and lesson development (using Apple Pilot and Aristotle's Apple).

As an extension of the training, six of the most interested and proficient inservice graduates were paid during the summer of 1981 to develop instructional software in their academic or trade areas. These efforts resulted in a vocational aptitude evaluation package for the guidance office, computer-assisted-instruction programs for the distributive education and culinary arts department, and software on grammar and sentence construction for the English students.

Training currently takes place on a regular basis through mini-courses which are conducted every five weeks after school for two-hour sessions. Each course is a basic introduction of the use of microcomputers and the use to instructional and administrative applications. Fifty staff members completed the two courses offered in the fall of 1982.

The master teacher's microcomputer office is used for training on a continual, informal basis. Teachers request time with the master teacher during free periods or after school, to learn anything from simple computer operations to basic programming.

Emerging Roles

To assist the initiation of microcomputer use in the district, the Superintendent created two new roles in the fall of 1981.

First, the Superintendent assigned one teacher the responsibility of being the "microcomputer master teacher". Previously a resource teacher in the developmental math lab, the master teacher now divides his responsibilities between his special education students and coordinating the microcomputer activities in the school. This master teacher is responsible for providing inservice training, maintaining the equipment, and serving as a continuing resource to the staff members and students.

Second, a staff person in the media center/library became the "microcomputer specialist" for the microcomputer center. The main responsibilities of the microcomputer specialist include scheduling and managing the use of the center's microcomputers and maintaining the district's software library. The microcomputer specialist also provides general computer literacy as well as independent computer projects to any interested student. In addition to his regular school hour functions, the microcomputer specialist also teaches adult education evening classes in computer literacy and a microcomputer summer camp at the school.

LINDEN SCHOOL DISTRICT
Linden, Michigan

Case Study Report

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The authors are grateful to Joe Hooper, Superintendent, for granting permission for the Linden School District to participate in this study. We would like to thank William Hummel for arranging the visit and assisting the research team on site. We also appreciate the assistance given us by all the other educators in Linden who met with us and gave generously of their time to make our efforts successful.

I. SUMMARY NARRATIVE AND CHRONOLOGY

The School District

The Linden School District is one of 21 independent school systems in Genesee County, Michigan. Linden is a small, rural district with a student population of 2,479 for the 1982-1983 academic year. The district occupies five buildings: a district building, two elementary schools (one building for grades 1-3 and one building for grades K, 4 and 5), a middle school for grades 6-8, and a high school for grades 9-12. In Linden, 99 percent of the students are white. The residential population numbers 11,744 persons.

Since 1981, the district has experienced slowly declining enrollment and a sharp decrease in public funds for education. The unemployment rate in the area is high (22 percent) due to layoffs in the automobile industry. These conditions have led to the consolidation of two schools, as well as reductions in "enrichment" courses (music, foreign languages, student newspapers, drama, etc.), athletic programs, guidance services, and teaching and non-teaching positions. At the present time there are no district-subsidized, extracurricular activities. In 1981, the school day was reduced by one hour.

There are 107 students served by the special education program district-wide. The special education supervisor is responsible for three school districts; he spends about one third of his time in Linden. The full-time staff consists of 11 special education teachers and 4 teacher aides. Three of the teachers are designated as teacher consultants; they provide assistance to mainstreamed special education students and act as internal consultants to the regular education teachers. All faculty members are responsible for maintenance of required special education reports on each assigned student. The district contracts for special student evaluations (psychological, etc.) with diagnosticians employed by a neighboring district. Special education services are provided in both resource and self-contained classrooms in all buildings.

Microcomputers were introduced in Linden by the special education program in 1979. Currently there are 14 microcomputers used for special education. In addition to these, the district has implemented other computer applications: a regular education microcomputer lab at the high school; access to a county-maintained mainframe computer for a career guidance program and for a variety of administrative functions (master scheduling, grade reporting, student records and payroll); and a minicomputer in the district office. Additional microcomputers at the

high school are used for upper level math and computer literacy instruction during school hours and for adult education computer literacy in the evening. The use of this technology is continuing to expand, with the acquisition of hardware and software occurring as funds become available.

Overview of Microcomputers Studied

At the time of the case study (March 1983) there were 23 microcomputers in the district. Our investigation focused on the 14 used for instructional applications with special education students. These 14 microcomputers are located in special education classrooms in each of the four school buildings and are only used for instruction of special education students.

- The two elementary schools each have one tape-driven Commodore PET, on which locally developed software in math and language arts is used.
- The middle school houses six Commodore PET and two Apple microcomputers distributed among four classrooms. The Apple II-Plus units are complete with color monitors, disk drives, and dot-matrix printers
- Each of the two special education classrooms at the high school contains two Commodore PETs, a printer, and disk drive. The microcomputers are used for drill-and-practice in the math and language arts curriculum.

Chronology

In the fall of 1979, two special education teachers at the middle school decided it would be useful to acquire microcomputers for the instruction of special education students. With no district funds available, and with approval from the special education supervisor, the teachers wrote a proposal and justification to use special education (flow-through Part B) funds to purchase one microcomputer. This request was granted. The teachers then approached the student council for money from fund raisers to purchase a second microcomputer and were also granted the funds. The two sources of funds were combined and used to acquire three microcomputers through a special "three-for-two" offer available on Commodore PETs.

The three microcomputers were distributed upon arrival to individual special education classrooms at the middle school. Because this was the first microcomputer implementation in the district, the teachers had to learn on their own how to incorporate this new technology into their instructional programs.

The expansion of the special education system has been accomplished primarily through the further allocation of special education flow-through funds for additional hardware and software. In the fall of 1980, three additional Commodores were purchased and in the fall of 1981, six Commodore PETs were acquired and distributed throughout the district. In the fall of 1982, a complete Apple II-Plus unit was added to the system. An additional Apple II-Plus was ordered in February 1983, using money raised by the special education faculty through the sale of bagels before school and during lunch. "Bagel money" has been used since 1980 to acquire peripheral equipment (floppy disks, printers, disk-drives) for the system.

Other peripheral equipment has been purchased with a 1981 federal grant which supported a research project entitled "A Model Program in Microcomputer Utilization with Handicapped Students." The grant application was written by one of the teachers originally involved in acquiring microcomputers. The grant money was used for additional disk drives, printers, and commercially produced software for math instruction. The project also provided for the development of teacher manuals on the use of the microcomputer, and for the development of a math curriculum software package. This project was conducted jointly with two neighboring school districts.

The major events in the implementation of microcomputers in the Linden School District are presented in Table 1.

Table 1: Chronology of Implementation

Linden
School
District

<u>Date Month-Year</u>	<u>Event</u>
<u>1979-1980 Academic Year</u>	
Oct. 1979	Two interested teachers seek permission to use special education funds to buy a microcomputer.
Nov. 1979	Three Commodore PETs purchased for middle school (Part B and other funds).
March 1980	A dual-disk drive and printer purchased with special education funds for middle school.
<u>1980-1981 Academic Year</u>	
Sept. 1980	Three Commodore PETs purchased and distributed: one to middle school; two to high school.
Nov. 1980	Special Education teachers begin selling bagels to raise money for microcomputers. Began proposal for grant application.
Jan. 1981	Proposal submitted for federal project.
May 1981	One dot-matrix printer and one Apple II unit purchased for middle school. Bagel money used for purchases.
Aug. 1981	Grant for federal project approved.

1981-1982 Academic Year

Sept. 1981

Five printers and two disk drives purchased with grant money; five disk drives and six Commodore PETs purchased with special education flow-through funds.

Jan. 1982

Apple printer purchased with "bagel funds."

1982-1983 Academic Year

Sept. 1982

Apple II unit purchased with special education flow-through funds.

Feb. 1983

Apple II unit purchased with "bagel funds."

II. FEATURES OF THE MICROCOMPUTERS

Introduction

The special education microcomputers are used solely by the special education faculty to provide computer-assisted-instruction (CAI). This application of the microcomputers in math and language arts areas has been integrated into almost every module of the curriculum for special education students. The software emphasizes drill-and-practice of skills introduced by the teacher. Experimentation with additional, special capabilities or potentials of the microcomputer is left to the individual teachers. Their initiative and levels of expertise with the technology determine the nature and extent of special applications made in each classroom.

There are currently 12 Commodore PETs and 2 Apple II-Plus microcomputers used in the Linden School District special education program. The Apple II systems are complete with disk drives, dot matrix printers, and color monitors. Seven of the Commodore PET microcomputers are equipped with disk drives and there are seven dot-matrix printers for use with the Commodore units.

At one elementary school the microcomputer is in the front portion of a "storage closet" inside the teacher consultant's classroom. At the other elementary school the computer is located in the back of a large classroom next to restrooms, drinking fountain, sink and counter. At the middle school the computers are distributed across four special education classrooms. Two rooms share two Commodore PETs with disk drives and printer and one Apple II unit. A third room contains two Commodore PETs with disk drives and a printer. The fourth room has two Commodore PET units with one dual disk drive and a printer. Each of the high school special education classrooms has two Commodore PETs, a disk drive, and a printer.

The microcomputers are used daily for CAI in math and language arts for special education students. No regular education teachers or administrators make regular use of these computers. Twenty-seven special education students in the elementary schools, 52 in the middle school, and 28 in the high school use the microcomputers.

Interviews with the special education teachers indicated that most of the microcomputers are in constant use during all scheduled class periods and that frequent requests to use the microcomputers during lunch periods are received and honored. The teachers indicated that all special education students

utilize the microcomputers for a portion of either language arts or math instruction each week and many for both subject areas.

Management of the Microcomputers

The Linden School District special education program is supervised by a one-third time director who reports to the Superintendent. There are 11 special education faculty members in the district, three of whom are designated teacher/consultants--one for each academic level (elementary, middle, and secondary). One special education teacher at the elementary level does not have a microcomputer.

The director of special education is responsible for and makes recommendations concerning acquisition, maintenance, and utilization of the microcomputers. These decisions must then be approved by the Superintendent. One teacher at the middle school has emerged informally as the district microcomputer specialist and his opinion is sought and considered in all decisions concerning special education microcomputers. During the course of the federal project, this microcomputer specialist was primarily responsible for technical aspects of the project: writing computer programs, purchasing equipment, providing inservice to staff and students, and disseminating materials. The principal of the middle school was primarily responsible for fiscal matters, for administering the research design, and for program evaluation. Now that the project has terminated, use of the microcomputers is determined independently within each school.

No standardized procedures exist for allocating hardware and distributing software in the district. Some units were distributed to the elementary and high schools as a result of their participation in the federally funded research project. These microcomputers have remained in the schools where they were placed.

The special education teachers at the middle school are the only ones in the district who are currently working to secure money for additional microcomputers and they will determine how this equipment will be distributed. Software acquisitions are coordinated informally. Interviews indicated that sometimes there were duplications in the review and ordering of software by teachers in different schools. Among the middle school faculty, there was evidence of pooling budget money; informal discussions also occurred regarding software purchases.

The 1981, federally funded project provided money for the development of special education math software for the district, the purchase of several commercial software math packages, and

extra materials for making duplicate copies. Individual teachers are acquiring software as their classroom budget allows, and are free to make visits to the county software library in Flint, Michigan. While there, they can copy public domain software on file. There is no central inventory of hardware or software in the district for special or regular education materials.

Suggestions for software purchases are made either directly to the director of special education or to the individual principals. The requests are forwarded to the district office in accordance with standard purchasing procedures. During the past few years the district's supply funds have been "frozen." Several teachers indicated that they are planning to use budgeted supply money to buy software when funds are "unfrozen." Software purchases are made for individual microcomputers within each classroom so software incompatibility between the Commodore PETs and Apple units is not a problem.

Illustrative Applications

To provide an idea of how the microcomputers are being used in the Linden schools, three illustrative applications are described below.

Computer Assisted Math Instruction in Secondary Special Education Class. Six students are clustered around two Commodore PET microcomputers. The classroom is arranged with chairs and desks in one section of the room and the two microcomputers are on tables with chairs to the rear of the desk area. The teacher explained that the students tend to watch other students interact with the computer if the units are visible from the desks. The teacher allows the students to engage in "academic" games (i.e., games designed to improve academic skills) for the last fifteen minutes of the period each day. The students are talking excitedly as they compete with each other and themselves. Emphasis is on individual competition and cooperation; the students encourage each other to increase individual scores from the previous day, rather than to "beat" each other. The game on one unit emphasizes number recall and the other practices multiplication skills.

Several students state that they enjoy coming to class more now because of the opportunity to use the microcomputers. One student expressed interest in studying computer science after graduation. The teacher is extremely supportive of the use of the microcomputer, but does not feel that the training for teachers has been adequate to give them the expertise to use the microcomputers to their full potential.

Individualized Instruction/Counseling in Elementary Special Education Program. The students report to the teacher consul-

tant at an assigned time in the resource room for special instruction or counseling to supplement regular education classroom activities. Most of these students are mainstreamed in regular classrooms for the majority of each day. The teacher talks with the students about how things are going in class and then either tutors individual students on a problem area or sets up the microcomputer for a student to practice skills. The students work individually at the microcomputer with either the teacher or the teacher's aide also sitting at the terminal to offer encouragement and extra instruction.

The microcomputer is located in a small storage room inside the resource room and gives the user and teacher complete privacy. There are two chairs at the terminal, ample room for teacher and student to sit and work comfortably. After the lesson, the student's progress is checked and a written or verbal report given to the regular classroom teacher as appropriate. Commercial programs (Milliken Math Series) as well as locally developed software in math is used.

Computer Assisted Instruction in Middle School Special Education Classroom. The teacher uses the microcomputers for instruction, but also for behavior management--good conduct is rewarded with "free play" time on the microcomputer. The teacher comments that there have been significant improvements in student behavior.

One student is practicing a vocabulary lesson at one of the two Commodore PETs in the rear of the classroom. The student is given a choice of words on the right side of the monitor from which to select and fill in the blanks in sentences on the left. With each correct response a bright starburst design appears and the student usually smiles. At the end of the exercise the student is given feedback as to the number of correct and incorrect responses. The teacher indicated that each student in the class uses the microcomputer for a portion of all math and language arts modules.

III. ORGANIZATIONAL ISSUES

Centralization and Decentralization

Microcomputer applications are mostly decentralized. Both the initiation and implementation of the system began at the classroom level. Although the director of special education prepares the special education budgets, he must divide his time among three districts and is not directly involved in day-to-day decisions regarding the microcomputers. The four building principals are responsible for equipment assigned to their schools, and individually authorize teacher requests for hardware or software to be purchased through classroom supply money. The decentralized functioning of the system is well established with no plans for centralized coordination or standardization, either at the building or district levels. There are no set procedures for sharing or distributing software, no district inventory of software housed in individual classrooms, and no mechanisms for evaluating software. Building principals are involved in coordination through the scheduling of classes.

The only activity involving centralized coordination was the federally funded project which required the coordination of microcomputers at all four district school buildings. During this time, the special education teacher consultant (and grant co-author) informally emerged as the "district microcomputer specialist." His opinion was sought regarding machine use, functions and repair, software suggestions, and funding sources.

The mainframe computer used by the Linden School District central office belongs to the Genesee County Intermediate School District. This Burroughs 9000 is used for student records, master scheduling, payroll, budget, grade reporting, and a career guidance program in the high school. No interaction between the microcomputers and the mainframe takes place.

Special and Regular Education Interaction

Special education students are mainstreamed to the extent their skills and abilities allow, and are assigned to special education resource rooms for intensive developmental and remedial work. This results in some students remaining in special education rooms for the entire day and others only for assigned periods. The special education teacher consultants interact with regular education faculty members about the needs of the mainstreamed students. These interactions may or may not include consideration of the computer-assisted-instruction that

takes place in the special education classrooms.

Although there are additional microcomputers in the district, no appreciable collaboration over any aspect of use was evidenced. This is largely due to a strictly enforced regulation requiring that special education microcomputers be used by special education students only. The regular education microcomputers were only open to students taking upper level math and science instruction.

Nevertheless, a few examples of regular and special education interactions have occurred:

- A special education teacher was asked to demonstrate the microcomputers in regular education classrooms. Two requests were made.
- An elementary special education teacher distributed a list of public domain classroom software to all faculty members in the school, and offered to make copies for interested teachers. No requests were made.
- Conversations transpired between an elementary special education teacher and a third grade teacher regarding ways to use the computer for instructional purposes.
- A middle school special education teacher was approached by a regular education home economics teacher with questions regarding the design of software for a nutrition class.

Administrative and Instructional Applications

Microcomputers are not used for administrative applications in the Linden School District. Two school principals, however, indicated that they recognized the future potential of such applications. Computer assisted administrative functions in the district are accomplished with a minicomputer and a mainframe terminal in the district office. There is no conflict or duplication of activities as a result of the introduction of microcomputers.

Training

The two teachers involved in planning for and initiating the special education microcomputers began reading about the use of microcomputers when approval for the purchase of microcomputers for the Linden School District was obtained. No formal training was provided by the district for the initial users of the system.

During the federally funded project, 1981-1982, 7 of the 21 teachers involved in the project received ten hours of computer literacy training and inservice training on the use of the specially designed software for the project. Three of these teachers were from the Linden School district. No other inservice training on using the microcomputers has been offered to the faculty. One special education teacher at the elementary school attended an inservice offered by the Genesee County Intermediate School District.

The Linden School District offers adult education classes in computer literacy. Several Linden school faculty members and administrators completed the course and several others were enrolled for future sessions. This course is available to school employees at a reduced cost and teachers are encouraged to attend.

Emerging Roles

There have been no new organizational roles created in the Linden School District related to the implementation of microcomputers. Informally, one of the middle school special education teachers is considered the local expert and is frequently called by other microcomputer users for advice. At every level in the district structure the opinion was expressed that if microcomputer technology is to expand and be effective in the schools, a "specialist" with time allotted to train and assist the users is needed. However, due to the financial constraints in the district at the present time, positions are being eliminated, not created.

TOWNSHIP OF OCEAN SCHOOL DISTRICT
Oakhurst, New Jersey

Case Study Report

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The authors are grateful to Robert J. Mahon, Superintendent, for granting permission for the Township of Ocean Schools, Oakhurst, N.J., to participate in this study. We would like to thank Glenn Morgan, the Assistant Superintendent, for arranging the visit and assisting the research team on site. We also appreciate the assistance given us by Leona Burke-Worth, Susan LeGlise, John Best, and all the other educators in Oakhurst who met with us and gave generously of their time to make our efforts successful.

I. SUMMARY NARRATIVE AND CHRONOLOGY

The School District

Ocean Township, a suburban, middle to upper-middle income residential community of 25,000, is made up of the towns of Oakhurst, Wanamassa, Wayside, and a number of smaller towns. Located on the New Jersey coast approximately fifty miles south of New York City, it is adjacent to the resort city of Asbury Park.

The community consists largely of professional, self-employed managerial, blue collar, and civil service personnel. Nearby electronic industries and the Army installation at Fort Monmouth employ a number of its citizens.

The Township of Ocean School District includes a district office building and five schools: a high school, an intermediate school, and three elementary schools. The present student population numbers 4,158. This enrollment represents a decline from a high of 4,900 several years ago. The school population is predominantly white, with approximately 5 percent Blacks and 5 percent Asians.

District administrators reported that school funding was "financially healthy" and that the local voters have approved all school funds requested in recent years. In New Jersey, the state education agency rates all school districts on the basis of their economic sufficiency, with a ten point scale from lowest to highest. Township of Ocean School District is rated at the ninth level.

The organization of special education programs is quite straightforward. The director of special services reports to the assistant superintendent of schools. Special education teachers and related personnel are responsible to the director and to their building principals. The special services program includes these personnel: director (1), learning-disability teacher consultants (5), nurses (5), physician (1), psychologists (2), social workers (2), speech therapists (3), special class teachers (8), resource room teachers (7), and supplemental teachers and aides (3).

Special services provides instruction within the district for 203 students with classified handicaps and 271 students who are "eligible for speech correction." Nineteen handicapped students are provided with instruction outside the district. In addition to special education, the district also offers instructional programs for basic skills students and for gifted/talent-

ed students.

At the time of the case study (February 1983), there were 48 microcomputer units in the district. Of these, 40 were part of a general, district-wide instructional program. The remaining eight microcomputers were used independently for administrative applications or for specific business education and industrial arts programs in the high school.

Overview of Microcomputers Studied

This case study focused on the 40 microcomputers that were used for general instructional applications. These include 37 Commodore PETs, a Commodore CBM, a Vic-20, and an Atari-800. The majority of these microcomputers are located in computer labs: 16 in the intermediate school lab and 13 in the high school lab. The remaining 10 are placed in individual classrooms and resource rooms. The Commodore CBM is located in the district special education office.

The microcomputers are used for a variety of purposes, but most of these fall into two major categories: (1) computer-assisted-instruction (CAI) and (2) computer literacy/programming. Examples of microcomputer use include the following:

- o Special education teachers in all the schools use microcomputers for CAI to support educational objectives and reinforce (with mainstreamed students) curriculum topics from regular education programs.
- o Basic Skills (Title I) teachers use microcomputers to provide computer-assisted instruction in math, spelling, and reading. Teachers select software appropriate for each student and, where the software allows, customize the CAI by changing "difficulty" and "speed" levels for each student.
- o Gifted/talented students in the intermediate and elementary schools are introduced to microcomputers through computer literacy and programming courses.
- o Math teachers at the high school offer courses in both basic computer literacy (introduction) and advanced programming for secondary students. The courses are conducted in the high school computer lab and between 300-

400 students are instructed each year. The lead teacher for this program plans on "full computer literacy" for all district students and is introducing computer courses at the intermediate school as well.

- Throughout the district, regular education teachers are beginning to use available microcomputers for CAI with their students. The applications are in reading, math, science, and languages.
- The director of special services is developing administrative applications for her department, using a Commodore CBM that was purchased specifically for that application.

The other computers (8) in the district are used for administrative applications and for business and industrial arts courses in the high school.

Chronology

Microcomputer use began four years ago (fall 1979) when the district math supervisor and several high school math teachers approached the assistant superintendent of schools with a proposal to purchase microcomputers for instructional purposes. Previously, computer programming had been taught by one of the high school teachers for eight years using the school mainframe computer. The assistant superintendent was enthusiastic.

Using funds from Title I, Title II, and gifted/talented budgets, 14 Commodore PET microcomputers were purchased in December 1979. A key decision was made not to distribute the machines until the teachers had received adequate training in their use. First, a district-wide awareness session was held on an afternoon in January. Then a series of voluntary, 16-hour inservice courses was initiated. To date, two-thirds (200) of the district teachers have completed this training.

The original 14 microcomputers were allocated among the three elementary schools, one intermediate school, and one high school. During the remainder of the first year of the program and throughout the second year, these computers were used by the Title I, gifted/talented, and high school computer science students. During the second year, however, most of the special education teachers and administrators completed the inservice training course. At the beginning of the third year (fall 1981), the special services division bought five Commodore PET

units, one for each of the five schools in the district, and a Commodore CBM with dual disks and a letter quality printer for the district office. The CBM is used for special education paperwork, especially required correspondence with parents. In addition, an ambitious project for automating part of the IEP development process is under way. The Commodore PET microcomputers at the elementary and high schools are located in special education resource rooms and self-contained classrooms.

Along with the microcomputers purchased by special services, additional equipment for all users in the district continued to grow. When the six special education computers were purchased in the summer of 1981, eight additional Commodore PET units were purchased for other purposes. A third set of 12 Commodore PET microcomputers was purchased in the summer of 1982.

Two factors that contributed to the expansion of microcomputers in the district were: (1) establishment of a core group of persons to coordinate and assist others in using the microcomputers; and (2) extensive provision of inservice training opportunities for all teachers in the district. The core group consists of a math teacher and the math supervisor, the assistant superintendent, and the director of special projects. From the initiation of microcomputer usage in the district (1979), this group has worked together to support and guide adoption and expansion of units in the district. One of their key roles has been to provide training and technical assistance to the teachers. This began with a district-wide awareness program in January 1980, and has continued through a series of training sessions. Not only has district training reached a majority of the local teachers, but 400-500 educators from other districts have participated in (and paid for) the training that the district provides.

The major events in the implementation of microcomputers in the Township of Ocean School District are presented in Table 1.

Table 1: Chronology of Implementation

Ocean School
District

Date Month-Year	Event
<u>1979-1980 Academic Year</u>	
Sept. 1979	Informal committee from math department meets with Superintendent and assistant superintendent to initiate planning for microcomputer implementation.
Fall 1979	Committee plans focus for initial application and identifies funding sources.
Dec. 1979	Delivery of first 14 microcomputers.
Jan. 1980	District-wide awareness session.
Feb. 1980	First training sessions for teachers (start of eight-week course, two hours per week).
Spring 1980	Committee establishes centralized software acquisition; math supervisor will coordinate all review and purchase of educational software.
<u>1980-1981 Academic Year</u>	
Throughout Year	First district-wide implementation of the microcomputers (after teachers had been trained): 6 in high school computer science 3 in intermediate school (gifted/talented program) 3 in one elementary school

(gifted/talented program)
1 in each of two elementary
schools (Title I labs--
"basic skills")

Spring 1981

Special education personnel
take introductory computer
inservice training provided
especially for them.

1981-1982 Academic Year

Oct. 1981

Second major acquisition of
microcomputers. Of 14, 6
are purchased with special
education funds.

6 more to high school compu-
ter labs
1 to high school resource
room (spec. ed.)
3 more to intermediate
school computer lab
3 to the special education
rooms in the elementary
schools
1 Commodore CBM to the ad-
ministration building for
special education use

Feb. 1982

First edition of district
newsletter published and
distributed to the community.
Contains extensive coverage
of microcomputer activities.

1982-1983 Acaemic Year

Oct. 1982

Third major acquisition of
(12) microcomputers. Most
(8) are added to interme-
diate school computer lab.

Oct. 1982

District initiates monthly
orientation/training pro-
grams for personnel from
other districts.

Feb. 1983

Second edition of district
newsletter.

Spring 1983

Microcomputer committee
plans linking curriculum
areas to educational software.

II. FEATURES OF THE MICROCOMPUTERS

Introduction

The instructional microcomputers in Ocean Township are located in all five schools in the district, but their highest concentration is in the intermediate school (16) and the high school (15). Eight microcomputers are distributed across the three elementary schools. One microcomputer is in the special education office. This concentration of microcomputers at the secondary level reflects the initial adoption for computer literacy/programming classes. Nevertheless, in all buildings microcomputer use is shared by teachers and students in different programs.

Each of the three elementary schools has one special education computer. These computers were purchased with special education funds and are located in special education rooms (resource rooms or self-contained classrooms). Special education students have priority use of these microcomputers and, in general, appear to use them more than 50 percent of the time. Special education students are mainstreamed to a great extent in these schools, and some may use other computers in basic skills classes. Two of the elementary schools also each have a microcomputer located in a basic skills classroom. The third elementary school has three additional microcomputers that were purchased with state gifted/talented funds and are used in the local program for "enrichment."

At the intermediate school (grades 6-8), all 16 microcomputers are located in a single computer lab. One of these computers was purchased with special education funds, but it is not distinguished from the other microcomputers as far as the users are concerned. Special education teachers schedule groups of students into the lab. Basic skills (Title I), gifted/talented, and regular classroom teachers also schedule time for their classes in the lab.

The computer lab is located in a tiered, "lecture-hall type" room. On each level there are long, curved tables with swivel chairs attached. The lab is actually a small amphitheater. In front, there is a large-screen television which an instructor can hook-up to a microcomputer for demonstration purposes. Fourteen microcomputers (Commodore PETs) are arranged around the tiered platforms. A Vic-20 microcomputer and an Atari-800 microcomputer are kept in an adjoining office, and may be brought into the lab for use or demonstration. A large software library (about 150 programs) is kept in ring binders that sit on a table at the front-left of the amphitheater.

This computer lab is in fairly constant use during the school day. Based on prearranged scheduling (handled by the school librarian), individual teachers bring their students into the lab for class periods. The principle users of this resource are the basic skills program, the gifted/talented program, and the special education program in the intermediate school. Priority availability of the microcomputers for these programs was based on the fact that they funded the purchase of the microcomputers.

At the high school, there is a computer lab with 13 units, another microcomputer in a special education resource room, and another in a basic skills classroom. The high school computer lab is used almost exclusively for secondary computer science courses (introductory computer literacy, basic and advanced programming).

The high school has two resource room teachers who teach alternate periods, sharing the single special education microcomputer. The microcomputer is used about 50 percent of the day, as one of many items in the resource room. The computer is on wheels and, when not used for special education, it is borrowed by foreign language or other regular education teachers. There is also a classroom for the emotionally disturbed in the high school, but they make very limited use of the microcomputer.

In addition to the instructional microcomputers, special education funds were used to purchase one Commodore CBM 8032 microcomputer with dual disk drives and a letter quality printer. This microcomputer is in the district office building and is used as a word processor for preparing special education materials and for processing mailings to parents. Currently, special education teams are developing a system for this microcomputer to prepare IEPs for special education students.

Management of the Microcomputers

During its four-year history of using microcomputers, the school district has developed an informal but very active and influential committee of key persons who coordinate and manage the instructional use of microcomputers: the assistant superintendent of schools, the director of special projects, the supervisor of mathematics (K-12), and a math/computer science teacher.

The Superintendent is not as directly involved in the day-to-day operation of the microcomputers, but he fully supports the implementation and has acted successfully to secure school

board support for the committee's efforts.

The informal committee exerts its influence over microcomputer implementation through the following mechanisms:

- The purchase, acquisition, and location of all microcomputer hardware is directed by the committee; they also identify available funds that can be used for hardware purchases.
- Similarly, software purchases are also directed by them. In particular, the math supervisor reviews all requests for software, submits orders to developers/distributors, and reviews all software when it is first received. What she doesn't like, she sends back. The committee also organizes and implements district-wide software reviews by teachers.
- The committee has established and regularly conducts extensive inservice training on microcomputers for teachers. Over two-thirds of the district personnel have participated in at least one of the courses. In addition, between 400-500 educators from outside the district have attended workshops or district-sponsored orientation sessions. Fees charged for attendance are used to purchase additional educational software in the district.

Illustrative Applications

To provide an idea of how the microcomputers are being used in the Township of Ocean School District, three illustrative applications are described below.

Computer-Assisted Instruction in an Elementary School Self-Contained Classroom. A group of five neurologically impaired students is in the classroom, working individually with various instructional materials. A boy and a girl, about seven years old, are assigned to the microcomputer. With a little help from the teacher, they select software from a box of about ten tape cassettes sitting on the table beside the microcomputer, and load it into the cassette tape drive.

The microcomputer displays a sequence of six or eight letters from the alphabet. One letter in the sequence is missing, replaced by a blank. The task is to determine which letter is missing and press the corresponding key. The two students take

turns, but they help each other when one seems to be having trouble.

Usually, they get the correct answer. When they do, stars immediately begin to appear one at a time, randomly scattered over the screen, until in a few seconds the entire screen is sprinkled with stars. The students' faces light up with excitement each time. Then they concentrate on the next set of letters that appears. When they make an occasional error, the program prompts them and gives them another chance.

After about ten minutes, the teacher directs the boy and girl to new tasks elsewhere in the room, and two other students take their places at the microcomputer. The new "users" load a program that teaches simple arithmetic skills and become absorbed in this activity while the teacher works with other students in the room.

Computer-Assisted Instruction in the Intermediate School Computer Lab. Six perceptually-impaired boys and girls are working in the computer lab. The lab is set up in a small lecture hall off of the school's central library complex. The hall has five curved tiers of tables that run the width of the room, broken only by a single aisle in the middle. Seats are permanently mounted to the support posts of the tables and are spring loaded to swing under the tables when not in use.

The lecturer's area at the front of the room is dominated by a huge TV set with a 4-foot screen. The screen is dark at the moment, but can be connected to a microcomputer for demonstrations by the teacher. Behind the computer, against the front wall of the room, are two long tables on which are arranged about 150 cassette tapes in notebook-like holders. These tapes contain the wide variety of computer programs available for use by the students.

Fourteen Commodore PET microcomputers are spread out along the first three tiers of tables. Each is equipped with a cassette tape drive. Six of these are now in use by the special education students. Most are working on arithmetic or language skills and practice programs. Some of the programs make use of game-like formats, but the emphasis in all cases is on a serious approach to building basic skills. The teacher moves about the room, observing the students and helping out where needed.

One boy, about 13 years old, is working on a reading practice program. The microcomputer presents text at a rate that is partially under control of the student. The program is designed to develop sight reading skills, including correct left-to-right scanning techniques. At the request of the teacher, the boy stops for a moment to explain some of the technicalities of the

computer sound system to the visitors. He is clearly very proud of his knowledge of the complex equipment.

The teacher explains that she has 20 students assigned to her special education resource room and that she schedules them into the microcomputer lab in small groups on a weekly basis. She assigns computer tapes to the students from the assortment of tapes on the tables at the front of the room, depending on the individual needs of each student. However, the tapes have been purchased to cover the complete range of students, from special education to gifted/talented. Thus, not all of the tapes are useful in her classes.

Computer-Assisted Instruction in a High School Resource Room. Four teenagers, three boys and a girl, are working in a small classroom. One boy and the girl are working on written assignments at tables in different parts of the room. The teacher works with the other two boys at the microcomputer, a Commodore PET with a cassette tape drive.

The program that the boys are using is designed to teach prefixes. It is one of about a dozen in the resource room. The boys are working on the many meanings of the prefix "sub-" and one finds the lesson quite difficult. Later, the teacher explains that he is good in math but has a serious problem with reading.

The program presents a meaning of "sub-" ("under") followed by an example ("submarine") and a list of about ten possible definitions. The task is to press the key corresponding to the correct definition. The boys take turns, and the teacher provides extra help for the one with the special reading problems. He has a hard time reading the long list of definitions, and the teacher gives him some prompts.

The complete lesson takes about fifteen minutes, and gives the boys a score at the end. One of the boys shows us how he can list the computer program on the screen and change what the program will display. He is enthusiastic about using the microcomputer for learning, and is also very interested in computer programming.

The second boy, the one with special reading problems, says he doesn't really like using the microcomputer very much, but he says it is better than most things he has to do in school. Afterwards, the teacher tells us that this boy has a very negative attitude about school, and the microcomputer is one of the few things that attracts his cooperation.

III. ORGANIZATIONAL ISSUES

Centralization and Decentralization

The district's use of microcomputers for instructional purposes contains elements that are centralized and elements that are decentralized. The informal, central committee (assistant superintendent, math supervisor, director of special projects, and math/computer science teacher) direct many important functions:

- initial adoption and selection of hardware
- allocation of microcomputers to schools and teachers
- review and acquisition of educational software
- teacher training and technical assistance

On the other hand, actual instructional applications are essentially decentralized. The central administration provides the hardware, the software, and the technical "know-how," but the teachers are very much left to determine their own particular use and application of these resources. The only minor exception to this pattern occurs in the computer science courses, which are planned by the math supervisor and the math/computer science teacher for the intermediate and high schools.

For the other instructional applications, individual teachers (special education, basic skills, gifted/talented, some regular education teachers) select the software they wish to use and schedule their own applications. In many of these cases (e.g., special education, basic skills) the software selection is further individualized for each student.

The administration is highly cognizant of this ultimate decentralization (and uniqueness) of specific applications. They expressed the opinion that this was important to encourage microcomputer implementation and that this flexibility prompted teachers to make more use of the technology. Nevertheless, they now feel that some more coordination is necessary. However, they stated that they hope new steps by the central administration, which they are now planning, would continue to support rather than control use of the microcomputers. One feature they would like to introduce would be a "curriculum guide" for educational software. They hope to link the district's educational software with specific curriculum (grade, subject matter, task)

objectives. This would serve to foster more selective and appropriate utilization of software by the teachers. As part of this process, they would also like to communicate availability of software better to the teachers and get more control over the distribution of software.

This current planning is associated with some minor problems noted in the schools. For example, the software "library" in the intermediate laboratory does not have a formal "check-out" procedure. Teachers (and students) can take software for their use and leave no record of who has it or when it will be returned.

Another problem is that teachers are often not aware of software in the district that can be used by them. A particularly striking example of this occurred in the high school. Three teachers, with whom we spoke, expressed interest in a type of software that would allow them to present individualized "practice-type" material. One teacher had been attempting, unsuccessfully, to identify commercial software for this purpose; another had purchased commercial software that proved useful; the third had worked with the math teacher (on the committee) to develop software for such an application. None of the three were aware of each others efforts. It is just this type of problem that the central committee is hoping to alleviate with better district-wide (and within-building) coordination and communication.

In terms of the centralization-decentralization of applications, it should also be noted the district has a centralized data processing department. Until about four years ago, the high school math teacher used the mainframe computer -- through batch processing -- to teach programming to students. This same math teacher is now one of the members of the district's informal coordinating committee. It was largely through his efforts that the initial decision to adopt microcomputers occurred. He was dissatisfied with the availability of time on the mainframe to support the needs of his students. He also felt that microcomputers were "able to do more" and represented a promising "personal tool for teachers and students."

The director of data processing is not directly involved in instructional uses of the microcomputers and feels that "as long as the microcomputers are serving those needs -- fine." However, he expressed concern over potential redundancies -- between mainframe and microcomputer applications -- in some of the administrative uses that are being planned or initiated in the district. He also believed that there should be more centralized control over the use of microcomputers and was concerned about eventual maintenance problems. However, his current obligations -- he is installing a new mainframe computer

-- prevent him from having much involvement with the microcomputer applications.

Special and Regular Education Interaction

Special education students are extensively mainstreamed in the district. There is no separate special education school and the great majority of handicapped students also participate in regular education. This strong level of interaction between the two programs is reflected in sharing of the microcomputers. In the elementary schools and in the high schools, regular education teachers often use the microcomputers that are provided to special education or basic skills classrooms. In the intermediate school, students from all programs use the computer lab.

A noteworthy aspect of this interaction was reported by a number of special education teachers. Because most of the microcomputers in the elementary and intermediate schools were acquired with special education or Title I funds, and priority usage of the equipment was given to students and teachers in those programs, these students have, to date, had much more experience with the microcomputers than the regular students have had. They are also more knowledgeable about the hardware and software. Teachers were very enthusiastic in telling us that -- now that the regular education programs are beginning to make use of the microcomputers -- the special education and basic skills students often demonstrate and explain the technology to their peers. This gives them a feeling of self-esteem and confidence and also fosters respect and friendship among the students. This was an unanticipated but welcome outcome for the special educators.

Administrative and Instructional Applications

The major thrust for adoption and implementation of the microcomputers has been to support instructional applications: computer-assisted instruction (CAI) and computer literacy/programming. In a few cases where administrative applications are planned or have been initiated, separate microcomputers -- two Apple II units in the business office; the Commodore CBM in the special education office -- have been purchased for those purposes. Consequently, to date there has been no competition or conflict between administrative and instructional users. A principal in an elementary school said that he had recently become very interested in potential administrative applications using microcomputers, through his exposure to the units in his school. However, he also stated that he planned to acquire a separate unit for such applications.

Training

The training program is a major feature of the Ocean Township microcomputer program. A decision was made at the planning stage that no microcomputers would be distributed to the teachers until they had undergone enough training to enable them to use the equipment properly.

The first step in the training program took place in January 1980, shortly after the first microcomputers were delivered. This step consisted of an afternoon awareness session of about two hours to which all teachers, board members, and other potentially interested personnel were invited. The awareness session gave everyone a chance to see the microcomputers running educational software and to receive some "hands-on" experience with the microcomputers.

Shortly after the awareness session, an inservice training program for teachers was announced. The first group started in February of 1980. Five groups (up to 20 per group) took the course during the first year. At the present time, over 200 of the 300 teachers in the district have completed the course, and more teachers are signed up for future sessions. Members of the coordinating committee and other local "experts" teach the inservice courses. In addition, a series of workshops and orientation sessions has been conducted for personnel from outside the district.

The course for Ocean Township personnel consists of eight two-hour sessions, one session per week. When the course was first offered, the objective was to teach participants to write programs in BASIC. This turned out to be unrealistic for teachers with no previous experience, and the course has been changed to cover (a) computer operations and (b) evaluating commercial software. Participants must also complete a project that involves some practical use of the microcomputers within two weeks of the end of the course.

While the course is completely voluntary, motivation for teachers to take the course is three-fold. First, teachers must complete the course in order to use the microcomputers. Second, completion of the course satisfies a district requirement for inservice needed to receive salary increments. Third, while the district charges fifty dollars for the course, teachers are reimbursed upon successful completion, so the course is, in effect, free.

Teachers who took the original version of the course (focusing on BASIC programming) have been allowed to retake the new version that focuses on computer use and software evalua-

tion. In addition, an advanced inservice course on microcomputer programming is now offered.

For teachers from outside of the district, a shortened version of the course is offered (four two-hour sessions). The content is similar to the course for Ocean Township personnel, but the emphasis is on introductory computer skills. The outside teachers are not required to complete a project or review software.

Emerging Roles

The microcomputer system has created several new teaching positions, both in high school computer science classes and in a teacher inservice training program developed in the district. However, the major new support role consists of an informal, half-time position as district technical support person. This position is held by a math teacher, who was a member of the informal district coordinating committee. Beginning in the fall of 1982, half of his work-day has been reassigned to e spent helping microcomputer users in the district.

He has a regular weekly schedule for working with the different users, but the particular tasks vary, depending on the needs of the users at the time. He helps with selecting software, setting up hardware, writing special-purpose programs, and teaching programming to intermediate school gifted/talented students. Virtually all users interviewed mentioned him as their main source for technical assistance.

The major change to an existing role was the addition of software coordination to the duties of the math supervisor. In this role, she coordinates all software ordering for the district, coordinates reviews of new software and returns items she judges to be unsatisfactory, distributes new software to appropriate users, and notifies other potential users about the location of new programs. At a more general level, she is the closest thing to a "supervisor of microcomputers" that exists in the district, although she has no official title relating to microcomputers. Additionally, microcomputer planning activities have been added to the responsibilities of all of the planning group members.

PITTSBURG UNIFIED SCHOOL DISTRICT
Pittsburg, California

Case Study Report

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The authors are grateful to Salvatore Cardinale, Superintendent, for granting permission for the Pittsburg Unified School District, to participate in this study. We would also like to thank Dr. Mario Menesini, Assistant Superintendent, for his help in arranging the visit and assisting the research team on site. We are especially grateful to Don Janes, Work Experience Coordinator for Pittsburg High School, who worked closely with us throughout the entire visit.

I. SUMMARY NARRATIVE AND CHRONOLOGY

The School District

Pittsburg, California, is situated about 20 miles east of Oakland and Berkeley. Although Pittsburg is only a ten minute drive from the relatively affluent towns of Concord and Walnut Creek, it is physically and psychologically isolated by a low range of rolling, grass-covered hills. Much of the population is poor, with a predominance of blue-collar workers and a high proportion of unemployed.

The Pittsburg Unified School District encompasses the entire town of Pittsburg. It includes about 6,000 students housed in ten schools: six elementary schools, two junior high schools, one high school, and one continuation school. The student population is not declining, and the schools are racially mixed, with roughly one-third Italians and other Caucasians, one-third Blacks, one-fifth Hispanics, and one-tenth Filipinos and other Asians. Within the past ten years, Pittsburg has been the scene of serious racial problems; now there is much less stress in the schools, and the staff is able to concentrate on improving the educational programs.

School funding in Pittsburg, as in all California schools, is perceived as a serious problem by school personnel. Budgets for both personnel and equipment are low, and items like microcomputers are paid for by state and federal grants, and parent donations.

Pittsburg is a small district and has a simple organizational structure. There are two assistant superintendents, one for instruction and one for personnel and business. The head of special education is the director of pupil personnel, who is responsible to the assistant superintendent for instruction. Special education personnel, serving 710 students, include 3 psychologists, a social worker, 13 special day class teachers, 10 resource specialists, 5 speech therapists, and 3 individual small group instructors. The special education classroom teachers and resource specialists have aides.

There are fourteen microcomputers used in Pittsburg for instructional and administrative applications coordinated by a high school counselor. Eleven of these units are in the high school, one is at the district office, and two are in elementary schools. These microcomputers are the subject of this case study.

A separate group of microcomputers has been located in the

Regional Occupation Program (ROP) classroom, some of them for the past three to four years. The classroom is in the high school, but the program is funded at the county level. Six Superbrains, two Apple II-Plus units and a CompuPro with five terminals are used to teach office skills, word processing, computer literacy, and computer programming to adult and high school students. High school computer literacy classes are taught during the last two class periods of the day. Few special education students are involved.

Pittsburg does not have a mainframe system of any kind. Financial and other business office computing is done via terminals connected to a service system outside of the district. The terminals are operated by two persons who report to the business manager.

Overview of Microcomputers Studied

During the last two years, the district has acquired 14 microcomputers for instructional and administrative applications. Most of these were acquired with vocational education funds, but two were purchased with special education funds. The high school career counselor/work experience coordinator and the district's assistant superintendent for instruction have been the principal forces behind the implementation of these units. The counselor/coordinator has also provided most of the training and technical assistance to users. In spite of the small number of microcomputers, a wide variety of applications are in place; including:

- Computer literacy and computer programming in the high school career center, and elementary school.
- Computer-assisted-instruction for basic skills in the high school; in the learning lab; the home economics class and elementary school.
- High school attendance and other student records;
- Special education records;
- Computer assisted drafting (CAD).

Chronology

The use of microcomputers in Pittsburg began in the 1980-1981 academic year. In the fall of that year, the Industry Education Council (IEC) placed an Apple microcomputer in a

junior high school for use in the special education resource rooms. The IEC is a cooperative venture between industry and education, with member companies providing the funding. The main office for Northern California is in Burlingame, near San Francisco, but there are satellite branches in other counties. The Pittsburg assistant superintendent of instruction was the president of an East Contra Costa County branch in 1980-1981. He played a major role in developing the Pittsburg microcomputer project and he has maintained a continuing interest in microcomputers for the schools.

After a year in the junior high school, the IEC Apple unit was moved to an elementary school, where it was used by the special education resource teacher. In the spring of 1982, the IEC withdrew the Apple and placed it in another school district. The elementary special education teacher was deeply involved with microcomputer uses at the time, and the district special education services rented another unit for him for the rest of the school year. In 1982-1983, an Apple IIe was purchased for his classroom out of special education funds, although it did not arrive until late spring.

In mid 1980-1981, the same year that the IEC program began, the high school career counselor/work experience coordinator installed two terminals that were connected to the Eureka California Career Information System in nearby Pleasant Hill. The Eureka system was very effective and he became interested in the potential for microcomputers in the vocational and special education programs.

During the spring and summer of 1981, the counselor/coordinator took a series of courses at the local junior college covering computers and computer programming. In the fall and winter of the 1981-1982 school year, he worked with the assistant superintendent of instruction and with the head of special education to obtain four microcomputers: a TRS-80 Model II for administrative applications, plus three smaller TRS-80 Model III units for instructional uses. One of the smaller microcomputers was purchased with special education funds, while the others were financed through a state vocational education grant. All four were delivered in February, 1982.

The four new microcomputers in the high school sparked a considerable interest among teachers and administrators. From spring 1982 through spring 1983, vocational education purchased three more microcomputers to use in a microcomputer lab, plus two more for vocational education classrooms. Other microcomputers have been purchased and a larger lab with twenty new microcomputers is planned for the fall of 1983. The counselor/coordinator has played a central role in the purchases and has provided the technical support for all of these microcomputers.

The major events in the implementation of microcomputers in the Pittsburgh Unified School District are presented in Table 1.

Table 1: Chronology of Implementation

Pittsburg Unified
School District

Date Month/Year	Event
<u>1980-1981 Academic Year</u>	
Sept. 1980	Pittsburg/IEC Apple microcomputer installed in a junior high special education resource room.
Dec. 1980	Eureka career information terminals installed in high school career center.
June 1981	Career center counselor/coordinator begins taking computer courses.
<u>1981-1982 Academic Year</u>	
Sept. 1981	Pittsburg/IEC Apple microcomputer moved to elementary school special education resource room.
Feb. 1982	High school gets four TRS-80's (three vocational education and one special education funded).
May 1982	Pittsburg/IEC Apple microcomputer withdrawn by IEC. Special education rents replacement. High school buys TRS-80 microcomputer for the office (attendance).
<u>1982-1983 Academic Year</u>	
Sept. 1982	Assistant superintendent for instruction and career center counselor/coordinator begin to prepare multiple proposals for additional microcomputers.
Dec. 1982	Vocational education buys TRS-80 microcomputer for home economics and drafting classes.

Feb. 1983

Vocational education buys three new Apple II units; sets up computer lab in library area. Special education buys Apple microcomputer for elementary school resource room. First district sponsored inservice training session.

II. FEATURES OF THE MICROCOMPUTERS

Introduction

The case study focused on the microcomputers that have been implemented for special education. The assistant superintendent of instruction has been a driving force behind this implementation. Through his position as president of the East Contra Costa County Industry Education Council (IEC), in 1980-1981, he was able to acquire the first microcomputer for the district. Although that initial adoption proved unsuccessful, he subsequently worked with the high school career counselor/work experience coordinator to foster adoption over the past two years of the current microcomputers in Pittsburg. With additional support from the special education director principals (especially the high school principal), and parent groups, 14 microcomputers have been acquired.

The microcomputers can be divided into two categories--administrative and instructional--which have existed in parallel since the first four microcomputers were purchased (winter of 1981-82).

Administrative Microcomputers. There are three microcomputers in this group, all TRS-80 Model II units. They are to keep records and maintain budgets.

The career center microcomputer occupies a very small, glassed-in office in the career center, and is used by the career counselor/coordinator and his advanced computer students for keeping statistics on vocational and special education students. A master file of every student in the high school, usable for lists such as mailing lists, is kept on one disk and includes information on special educational status, vocational education programs, and minimum-competency-test scores. Equipment inventories and budgets are kept on other disks.

The attendance microcomputer is in a room off of the main office in the high school. It was bought in May 1982, the only microcomputer in the high school to be purchased with school funds. The counselor/coordinator worked with a computer consultant to set up an attendance program and it is now used daily by two secretaries in the office to enter all absent and tardy reports. The microcomputer can produce a variety of records on individual students or groups of students, and can show attendance by day or by class period.

The ESEA microcomputer was purchased under an ESEA grant for administrative purposes. It is used to prepare a file of

all special education students, and the district is considering using it to develop IEPs. The counselor/coordinator set up the file using the Profile software program.

Instructional Microcomputers. The instructional microcomputers are divided into those in a "lab" and those in individual classrooms. The computer lab in the library area has three Apple IIe units and three TRS-80 Model III units, equipped with single disk drives and two dot matrix printers. The microcomputers are used by vocational and special education students for learning basic skills, and by the career center counselor/coordinator's advanced computer students, who serve as student aides and develop software for use by the teachers. Four of the six microcomputers were recently purchased; two had been in the career center since February 1982.

All but one of the five microcomputers in the individual classrooms are new, and applications are still being developed. The TRS-80 Model III located in a corner of the high school reading lab was purchased in February 1982, and has been used for reading and language instruction. The remaining four are used in computer-assisted-instruction in the following areas:

- a home economics classroom, used to teach weights and measures and give tests;
- a drafting room used for computer assisted drafting;
- an elementary special education classroom for teaching basic skills and programming; and
- an elementary gifted/talented classroom used for computer literacy.

Management of the Microcomputers

The microcomputers in Pittsburgh have been purchased with vocational education or special education funds, and the funding source is the primary determinant of how they are allocated. There are no formal procedures for purchase, allocation, or use of microcomputers set up in the district; management of the system falls into the hands of four key people. The assistant superintendent for curriculum and the director of pupil personnel authorize purchases for the microcomputers. In addition, the assistant superintendent for curriculum assists in developing new microcomputer applications in the district. The principal of the high school also participates in approving purchases. The career counselor/work experience coordinator operates as an informal technical support person for all microcomputer

applications and makes most of the day-to-day decisions regarding their use. Although he has no time allocated specifically to microcomputer administration, he provides training to teachers, assists in identifying, acquiring, and developing software for the various applications. There are no formal procedures for software accession, use, or coordination in the district.

Illustrative Applications

To provide an idea of how the microcomputers are being used in the Pittsburgh schools, three illustrative applications are described below.

CAI in High School Microcomputer Lab. The microcomputer lab is one of several rooms adjoining the high school library. It is as large as a classroom but is irregular in shape and shares the high, cathedral ceilings of the main library room. A folding wall is more than half open, but serves to divide the room lengthwise into two long, narrow areas. The door from the library opens into an area that is used to store a number of pieces of AV equipment and other items.

To the right, beyond the half-open sliding wall, six microcomputers and two printers are arranged on tables placed against the longest wall. Three of the microcomputers are Apple IIe units and the other three are TRS-80 Model III units.

Two groups of special education students (12 in all) are working at the microcomputers. A teacher and a student aide (from the high school "special projects" computer class) are working with each group. An adult aide is also working with one of the groups.

The learning disabilities group is working with the Apple microcomputers, learning to use LOGO to draw geometric figures on the screen. They have just begun to learn to use LOGO, and most can only copy sample programs from the manual. The student aides help them with problems and demonstrate how to do other things with the LOGO turtle. The second group is working with the TRS-80 microcomputer, using instructional programs for developing reading, language, and math skills.

CAI and CMI in a High School Reading Lab. The reading lab provides a regular elective course for any students who are having trouble passing the state-mandated competency tests, who want to brush up for the military ASVAB test, or who just feel that they need to improve their reading skills. Some special education students take the course, but many of the students are not in any special program. The course is offered five periods

per day, with 15 students each period.

The lab is housed in a regular classroom, but it is distinguished by a collection of carrels and small tables that replace the normal classroom desks. A number of bookshelves filled with reading materials divide the room into two main sections.

The microcomputer, is on a table in an attractively decorated front corner of the room. Each student is required to work at the microcomputer for a set period every week. The computer work counts toward their grade, and students must log in to show that they have met their obligation. The teacher says that, actually, the microcomputer is a real incentive for the students, and the student at the microcomputer agrees. Students who complete their regular work can get extra time on the microcomputer and are encouraged to do so.

In addition to the instructional programs, the teacher also makes use of a program for determining the reading level of text books. Not only does she use it for her own classes, she also provides a service to other teachers, computing reading level ratings for texts and other materials that they submit to her.

Individualized Instruction in Administrative Applications.
The administrative microcomputer is used mainly by the high school's career counselor/work experience coordinator, who is in charge of the career center. He is also responsible for a "special projects" computer class (an individualized class for advanced computer students), and some of his students use this microcomputer to develop new administrative applications. Some have also learned word processing and are using the microcomputer to prepare scholarship applications.

The microcomputer was originally purchased in February 1982 to keep records for the vocational education and career counseling programs in the high school. The counselor/coordinator's previous background in special education (he was a special education teacher) ensures that the needs of handicapped students are met in the vocational programs. The vocational education files include over half of the 1,500 students in the high school and store several dozen items of information on each student--from courses taken, to ethnicity and vaccination records. Other files are maintained for budgets and equipment and inventories. A master file of all students in the school is maintained on a single disk, and includes names, grade levels, and state competency test records.

The benefits of this program are two-fold. Administrative functions in the high school--especially vocational education, special education, and counseling records, reports, and planning--are improved through this automation. Second, the advanced students learn to use the microcomputers in real-life situations. The applications depend on their knowledge and expertise with the software.

III. ORGANIZATIONAL ISSUES

Centralization and Decentralization

The degree of centralization/decentralization of the microcomputers is based on several characteristics: the initial decision to adopt, the decision to assign and locate the microcomputers, the degree of coordination in using the microcomputers, and the organization of the software resources. The use of microcomputers in Pittsburg has both centralized and decentralized features which vary depending on the application being addressed.

The initial impetus for use of microcomputers came from the assistant superintendent of curriculum, who was responsible for introducing the first microcomputer into a junior high school special education classroom. The first attempt did not prove successful and the microcomputer was withdrawn. He then redirected his efforts to supporting the career counselor/coordinator, who was simultaneously attempting to use computer applications to improve instructional and career guidance programs at the high school. Although the initial decision to adopt may be said to have been decentralized, district support for purchasing and development of applications was provided.

Initiative for the other applications came from a Parent Teachers Organization and individual teachers: for purchasing microcomputers and implementing applications in the elementary gifted/talented program and in the high school reading lab.

At the district office, the assistant superintendent for curriculum and the director of pupil personnel services (special education) approve funds for microcomputer purchases. The counselor/coordinator reports directly to the high school principal, who has also provided funds for purchases.

Allocation decisions are based largely on the source of funding used in microcomputer purchases -- voc-ed funds for vocational computers, special education for special education microcomputers; etc. Within this general constraint, allocation is also determined by the specific need and interests of the administrators and users. This process is assisted by informal planning and "propagandizing" by the assistant superintendent, the high school principal, and the career center counselor/coordinator. They jointly reach decisions about which program areas would benefit from microcomputer use. The counselor/coordinator then identifies teachers that would be interested in using the equipment and provides them with preliminary training and orientation, before the microcomputer is acquired. Then the unit is

placed where the teacher who is most committed, or has the best plans, can use it.

Although no formal coordination procedures are in place, the counselor/coordinator assists a variety of users in the high school, in both administrative and instructional applications. He meets regularly with the district assistant superintendent to plan future microcomputer approaches, as well as other innovative programs for the district. He also assists the district special education director in developing administrative applications on the microcomputer placed in the district offices. The high school principal has full authority over the allocation and use of microcomputers in the high school. He often discusses and plans allocation and use of microcomputers in the high school with the counselor/coordinator. Ultimately, however, the actual day-to-day use of the microcomputers, especially in instructional applications, is determined by the teachers.

There are no formal procedures for software acquisition, use, or coordination. The counselor/coordinator is most knowledgeable about software (all district-received mail relating to software is automatically routed to his mailbox) and he advises users on selection of software. He also shares his software with others and modifies or produces custom software for users. Based on his recommendations, individual users may purchase software with local building funds, district funds, special education funds, or any other money (e.g., high school BINGO and booster club money) that is immediately available. There is no centralized "library" of software, but the counselor/coordinator knows where most software is held, and borrows or shares software (including his own) among users.

Special and Regular Education Interaction

From the beginning of the high school microcomputer applications, collaboration between special and regular educators was intended. A serendipitous factor in this collaboration is the fact that the counselor/coordinator was a former special education teacher. Even before the introduction of microcomputers, the career center services had a strong focus on the needs of handicapped students. The collaboration, however, is limited to shared use of the equipment and to some teachers (e.g., home economics, reading lab) using the microcomputer with both special and regular education students.

The major benefit of shared usage of the equipment (especially in the learning lab) is the availability of more hardware/software for both groups of users. Special education students in the high school are highly mainstreamed. The regular education programs that use microcomputers are open to both regular and special education students. In such cases, the dif-

ferences in applications between students is transparent.

Administrative and Instructional Applications

The initial adoption of the one IEC microcomputer was intended solely for instructional use in a junior high school special education class. This adoption was not successful and the subsequent adoption and growth of microcomputers in the high school was implemented with an intended mix of both administrative and instructional applications. Thus, the first four microcomputers purchased by the district were acquired, at the outset, for both administrative and instructional uses. Three of the four microcomputers were smaller TRS-80 Model III units, selected for instructional applications. The fourth was a larger TRS-80 Model II selected for administrative applications.

In later purchases, some microcomputers were pre-planned to be allocated to classrooms or the learning lab; others were scheduled for placement in the career center or in offices. For administrative applications, only TRS-80 Model II units have been purchased, so software that runs on one will run on all. All other available funds to purchase software (estimated to be \$1,500 - 2,000) have been spent on instructional software.

There are no formal district policies or procedures for coordinating instructional and administrative applications. However, with one exception, the microcomputers are all specifically designated for either instructional or administrative use; not both. The exception is a TRS-80 Model II in the career center office. This unit is used for administrative applications and for instructional use. The instructional applications on it consist of computer literacy and computer programming for advanced students in the high school. The counselor/coordinator manages this shared usage and it has been very effective. In fact, both applications benefit from the interaction:

- The students learn computer operations in a realistic environment; their "lessons" include data entry and report preparation of real data and reports that are used by high school and district administrators. Based on this experience, the counselor/coordinator has been able to place some students in computer-related jobs.
- The administrative functions benefit from the student "labor;" more reports can be generated with better turn-around time. (Students do receive some payment for their participation, through a vocational education grant program.)

Training

Very little formal or group training on microcomputers has been provided by the district. During the initial IEC microcomputer implementation, an outside consultant provided a workshop for junior high school special education teachers. Shortly thereafter, the junior high school special education teacher who received the IEC microcomputer also presented some training to other teachers. Both of these initial efforts, however, concentrated on computer programming and were not well received by the teachers.

In the last two years, the high school counselor/coordinator has provided individualized training and technical assistance to new users. The counselor/coordinator, himself, is essentially self-taught regarding microcomputers, although he did take some college courses in the summer of 1981 on computer programming.

In February 1983, the first district-wide inservice training session was offered. The counselor/coordinator presented a four-hour introductory workshop to 20 teachers. These included teachers who were just receiving their microcomputers. The district is planning similar inservice training for fall 1983, when 20 new microcomputers will be acquired and placed in a new computer lab in the high school.

Emerging Roles

No new staff positions related to microcomputers have been established in the Pittsburgh school district. One person, the high school career counselor/work experience coordinator, is, however, the de facto coordinator for microcomputer applications. He has assumed this role on the basis of his recognized expertise and enthusiasm for microcomputer implementation in education.

In addition to his official roles as career counselor/coordinator and his unofficial role as microcomputer specialist, he also provides other services in the district. He works closely with the assistant superintendent for instruction and the high school principal to plan and develop special projects. One of these, for example, is MESA--Mathematics, Engineering, and Science Achievement. This is a state-supported, opportunity program for talented students from disadvantaged backgrounds. He also coordinates vocational education programs in the high school and, when time allows, works individually with students.

As a counselor/coordinator, he is able to schedule his own time in the high school. He uses some of his time to provide

training and technical assistance to microcomputer users, to offer individualized instruction in computer literacy and programming, to counsel students, and to fulfill many other vocational education and counseling responsibilities. Both the assistant superintendent and the high school principal rely heavily on his assistance in these areas.

PRESCOTT UNIFIED SCHOOL DISTRICT NUMBER ONE
Prescott, Arizona

Case Study Report

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The authors are grateful to Dr. Ken Walker, Superintendent, for granting permission for Prescott Unified School District to participate in the study. We would like to thank Bruce Eldredge, Computer Coordinator, for arranging the visit and assisting the research team on site. We also appreciate the many staff people and teachers who met with us and gave generously of their time to make our efforts successful.

I. SUMMARY NARRATIVE AND CHRONOLOGY

The School District

The Prescott Unified School District encompasses the small, rural, western community of Prescott in the central part of Arizona. Known as the "Retirement City of the North," Prescott has a residential population of approximately 20,000. There is no industry within the area, so the major sources of employment are the Veteran's Hospital and the school system. Prescott's history as a gold mining town makes summer tourism another economic resource for its residents.

The school district has eight school sites: five elementary schools (K-6), two junior high schools (7-9), and one high school (8-12). The central administration building is situated in the center of town, while the schools are scattered along the outskirts. Approximately 4,470 students attend the Prescott schools. The ethnic composition is 80 percent White, 12 percent Hispanic, and 2 percent Black and Asian.

The special education program in the district serves about 450 students which includes those with sight and hearing impairments, learning disabilities, and emotional and physical handicaps. Presently, there are 27 special education teachers in the Prescott schools. This represents a dramatic increase from 3 teachers ten years ago. In addition to the special education teachers, there are 3 psychologists, 2 speech therapists, and 1 physical therapist. One of the psychologists also acts as the coordinator of special education for the district on a part-time basis. He is responsible for special education program activities and provides overall supervision for the special education teachers (building principals are their immediate supervisors). The coordinator reports to the assistant superintendent of educational services who is responsible for all the instructional programs and personnel in the district. As one of two assistant superintendents, he is directly responsible to the Superintendent.

Special education students, as well as all other students in the district have access to approximately 300 Commodore PET microcomputers at all grade levels for computer literacy courses, computer-assisted instruction, and programming. The Special Education/Vocational Education program has an Apple microcomputer for a vocational diagnostic project with the junior and high school special education students. The district administration uses an IBM System 34 minicomputer system for its accounting, budgets, payroll, student records, and other business functions.

Overview of Microcomputers Studied

The approximately 300 Commodore PET microcomputers in Prescott are used for a variety of instructional and administrative applications. Examples of microcomputer use are:

- Special education students in resource rooms receive computer-assisted instruction in academic areas, such as math and spelling; microcomputer software is also used to foster eye-hand coordination.
- At the high school, computer science courses include introduction to computer operations and BASIC programming. The skills taught include flowcharting, documentation, problem-solving, and writing "readable" programs.
- The gifted/talented students in the 4th-12th grades use microcomputers to learn programming in BASIC language. Students have written programs to calculate the perimeter of a triangle and the area of a square.
- In the junior high school, science students are using a microcomputer to control the environment to stimulate the growth of a tree as part of a research project.
- At the elementary level, all 4th, 5th, and 6th grade students receive two weeks of computer literacy instruction on the microcomputers. In addition to "hands-on" experience, students discuss the history of computer development and the computer's impact on society.
- The Chapter 1 Reading Labs are equipped with microcomputers for computer-assisted instruction in reading, grammar, and spelling skills.
- All of the elementary and junior high schools use microcomputers equipped with small, mark-sense card readers to score and process the district developed Continuous Uniform Evaluation System (CUES) tests.
- Administrative uses of a microcomputer in one of the junior high schools includes attendance, grade reports, class scheduling, equipment inventories, and mailing labels.

Chronology

In the fall of 1978, a committee composed of the director of several federal projects, two secondary computer science teachers, and a fourth grade teacher, decided to write a proposal for an elementary/junior high computer literacy project. Prior to that time, the district offered limited instruction in computer programming for secondary gifted/-talented, students with terminals connected to the local college's mainframe computer system. Microcomputer use was limited to one TRS-80 unit bought by the fourth grade teacher for instructional applications in his classroom.

With funding from the ESEA Title IV-C grant, the first 40 Commodore PET microcomputers were purchased in July 1979. Project funds also supported the development of a computer literacy curriculum to be piloted in the fourth grade. The curriculum encompassed four areas of computer literacy--the history of computers, career exploration, the social impact of computers, and basic programming. The computer literacy curriculum also served as the basis for the first teacher training course offered at the local community college later in the summer. The course was aimed at preparing the elementary school teachers to teach computer literacy.

In the fall of 1979, a computer lab for computer literacy classes and some programming was established at the junior high school. At the elementary level, two groups of ten microcomputers were rotated to each of the schools for six weeks for computer literacy classes with the fourth grade students. In January 1980, the computer literacy curriculum was expanded to include the fifth grade students.

In the summer of 1980, the district allocated funds for the purchase of ten Commodore PET microcomputers. This purchase signaled the beginning of the district's financial support of the microcomputer program. The Superintendent stated that the district had a history of taking innovative programs that had received external funding, and then continuing to support them as viable and on-going parts of the district's curriculum. The district also began to fund a part-time microcomputer position when funding for the federal project director's role was ending.

Beginning in the fall of 1980, an advanced inservice course was offered for teachers to learn more advanced programming techniques. The focus of the course was on developing computer-assisted instruction programs for use in the elementary and junior high schools. About a third of the teachers who took the

introductory course went on to take the advanced course. Over 200 of the 270 teachers in the district have taken the introductory inservice that runs 16 weeks, with two hours of lecture and two hours of lab per week.

In addition, a computer literacy course based on the elementary school curriculum was offered to community members in September 1980. The course has been given four times and a total of 240 participants have attended the sessions.

-During the 1981-1982 academic year, the district purchased 40 Commodore PET microcomputers with local and special education funds. The computer literacy curriculum was revised to include courses for the sixth and seventh grade students. Microcomputer units were rotated less among schools, with units being allocated to individual classrooms or computer labs within sites. The Commodore PETs purchased with special education funds were assigned to resource rooms in the elementary schools. Use of the microcomputers began to expand to include computer-assisted instruction at the elementary level and more programming in the secondary schools.

In the summer of 1982, the computer coordinator organized a paid working group of teachers and high school students to do a systematic review of software programs. The ultimate product was a catalog of recommended programs with brief descriptions and outlined instructional objectives. The distribution of the printed software catalog, in January 1983, coincided with the establishment of software libraries in each elementary school.

The district continued to make additional purchases of microcomputers--70 Commodore PET units in September 1982 and 16 Commodore PETs in February 1983. In January 1983, a pilot basic skills computer lab with 31 of the microcomputers was established in an elementary school.

The major events in the implementation of microcomputers in the Prescott school district are presented in Table 1.

Table 1: Chronology of Implementation

Prescott School
District

Date Month-Year	Event
<u>1978-1979 Academic Year</u>	
Sept. 1978	Feasibility study conducted of computer use in district.
Sept. 1978	Elementary teacher brings own TSR-80 microcomputer into classroom.
Jan. 1979	Steering committee formed for Computer Literacy.
Jan. 1979	Proposal submitted for Title IV-C Computer Literacy Project.
April 1979	Title IV-C Computer Literacy Project funded.
July 1979	Purchased first 40 Commodores (30-Title IV-C funds, 10 Voc Ed funds.)
Summer 1979	Developed curriculum for 4th grade computer literacy course, teacher training, and jr. high school class.
Aug. 1979	First 16 week teacher training course offered at local community college.
<u>1979-1980 Academic Year</u>	
Fall 1979	Inservice workshops on computers held for district's teachers.
Oct. 1979	First taught 4th grade computer literacy and gifted/-talented jr. high and high school programming course.

Jan. 1980	Taught computer literacy in 4th and 5th grades.
Summer 1980	Further developed 4th grade computer literacy curriculum and added 5th grade section.
July 1980	Purchased 10 Commodores with district funds.
Summer 1980	Offered summer school for 7th, 8th, & 9th grade students in computers with Career Education Grant.

1980-1981 Academic Year

Sept. 1980	Federal project director became computer literacy project director.
Sept. 1980	First advanced teacher training and district patron computer course offered at local community college.
Oct. 1980	Held statewide mini-conference on the Microcomputer Literacy Project.
June 1981	Purchased 40 Commodores with district and local special education funds.
June 1981	District funded part-time microcomputer coordinator position.
Summer 1981	Revised computer literacy curricula and developed 6th grade computer literacy course.

1981-1982 Academic Year

Sept. 1981	Microcomputers placed into special education resource rooms.
March 1982	Developed five-year plan for

	computer projects in district.
June 1982	Purchased 31 Commodores with Title IV-C funds.
Summer 1982	Software evaluation committee formed to review programs.
<u>1982-1983 Academic Year</u>	
Sept. 1982	Purchased 70 Commodores with district funds.
Sept. 1982	Articulation meeting held with local community college.
Jan. 1983	Set up pilot basic skills computer lab in elementary school with 31 Commodores.
Jan. 1983	Printed software catalogue and organized software libraries in each school.
Feb. 1983	Purchased 16 Commodores with district funds.
March 1983	Microcomputers allocated to six Chapter 1 Reading Labs.

II. FEATURES OF THE MICROCOMPUTERS

Introduction

Presently, there are approximately 300 Commodore PET microcomputers in the Prescott school district. The majority of these units are equipped with cassette players. However, there are some microcomputers with disk drives and printers in the schools and in the district office. Four of the five elementary schools have approximately 20-30 microcomputers with 2 or 3 units assigned to individual classrooms. The other elementary school has a basic skills computer room with 31 Commodore PET units networked together.

When computer literacy classes are being taught in the elementary schools (about half the school year), all the microcomputers in a school are moved together to create a computer literacy lab. The remainder of the school year, the principal and teachers at each school decide where to locate the units. Allocation decisions receive final approval from the coordinator of computer education. He is often involved in moving the microcomputers and seeing that they are set up properly after a move.

In the past, sets of 10 or 12 microcomputers were transported from one elementary school to another for the computer literacy classes. Now that is not necessary, since every elementary school has enough units for its computer literacy needs.

The two junior high schools have computer science labs with 15-20 microcomputers in each one. In addition to the labs, microcomputers are located in various classrooms or departments for use by individual teachers with students. In one of the junior high schools, the office has a microcomputer for administrative functions. The total number of microcomputers is approximately 35 in each junior high school.

The high school has a similar distribution pattern for microcomputers. There are two computer science labs with 15 microcomputers in each and approximately 12 units distributed in classrooms and departments throughout the school.

The special education resource rooms and the Chapter I reading labs in all the schools have been allocated microcomputers on a permanent basis. The coordinator of computer education has two Commodore PET units in his office for reviewing and cataloging software and for some other minor administrative tasks.

Within the individual classrooms, microcomputers are usually placed in a corner or to the side of a room to be separated from other classroom activities. It is entirely up to the teachers to arrange and use the microcomputers as they wish. The coordinator of computer education, along with other teachers, is available for assistance and support in the utilization of the microcomputers.

The microcomputers allocated to the elementary schools are used primarily for computer literacy courses and computer-assisted instruction in individual classrooms. The two-week computer literacy courses for all the 4th, 5th, 6th, and 7th grade students utilize the "lab" microcomputers full-time for approximately half of each school year. The microcomputers located in classrooms, including resource rooms and reading labs, are in use by students about 70 percent of each school day. The junior high schools and high school computer labs are scheduled for use all during the day for either computer literacy or programming classes. Microcomputers located in the secondary classrooms or departments also are used on a constant basis by individual students for drill and practice and skill reinforcement.

Management of the Microcomputers

The microcomputers were originally coordinated and managed by the Title IV-C project director with the assistance of the other three members of the proposal-writing committee. After two years, the project director left the district and one of the committee members was appointed half-time computer director while continuing to teach computer literacy half-time. The computer director serves as the major curriculum and technical support person for the entire computer program and a major driving force in its growth and expansion in the district.

Basically, all the microcomputers are considered to belong to the district rather than to individual teachers or schools, except those allocated to Chapter I reading labs or special education resource rooms. The computer director is responsible for all purchasing. This is currently accomplished with district funds for bulk orders of Commodore PET microcomputers. The computer director also decides on the allocation of the equipment to buildings. Principals and teachers may, however, decide on their actual locations within the schools.

Requests for new microcomputers are initiated by teachers and coordinated by the computer director. Because of budget constraints, not all requests can be met, and the computer director decides on which request will have highest priority.

The computer director is also responsible for all training and maintenance in the system.

The computer director coordinates all software orders and distribution. Requests may come from teachers or the computer director may order items himself. Usually he screens new programs briefly and then asks others to review the programs more in depth. One copy of each program is kept in a master collection in the computer director's office. Additional copies are distributed to the schools as appropriate.

Illustrative Applications

To provide an idea of how the microcomputers are being used in the Prescott schools, two illustrative applications are described below.

Seventh Grade Computer Literacy. An 18-week computer literacy course for seventh graders is designed to familiarize the student with the operation of the microcomputer. It also entails the study of the computer's impact on society and the careers available in the area of computers.

All seventh graders are required to take the semester course in computer literacy with the option then of taking an elective computer science course in the eighth and ninth grades. Students use computer labs in both junior high schools, equipped with 14-15 Commodore PET microcomputers, for the "hands-on" portion of the course.

Prior to using the microcomputers, students discuss the various applications and uses of computers including information management, graphics, telecommunications, word processing, and instruction. One week is spent on the study of the historical development of computers. A "current events" approach is used to discuss the social ramifications of computer uses on society. The text for the course is Are You a Computer Literate? by Karen Billings. This is supplemented with additional articles and readings.

The second half of the course focuses on computer programming in BASIC and skills such as flowcharting and problem-solving. Besides learning programming skills, students are taught the use of tables, arrays, and sorting; the use of peripheral devices (printer, disk drives); and the use of machine memory (PEEK/POKE). Each student is expected to use these skills for an independent project in developing a computer game or graphic demonstration. Part of the project assignment includes exploring potential markets for the programs.

Computer-Assisted Instruction in Special Education Resource Room. Microcomputers are being used in the elementary school resource rooms to provide special education students with computer-assisted instruction. Each resource room is equipped with one Commodore PET unit with cassette drive and an assortment of 20 program tapes. The programs are used to reinforce basic skills, such as mathematics and spelling, and to develop visual motor and eye-hand coordination skills. According to one special education teacher, the microcomputer is like having an extra aide in the classroom. "The computer can keep several students busy and that allows us time to concentrate on working with one or two students."

A sample program that elementary students use on the microcomputer is one called "drag racing." Students are presented with multiplication problems that vary in terms of difficulty. Correctly answering the problem moves an animated car along a race track. Incorrect answers prevent the car from reaching the finish line.

Usually students work individually at the microcomputer with the assistance of a teacher's aide. The aides are responsible for teaching each student basic computer operations and selecting programs that correspond with student's learning objectives. With 20 students scheduled into a resource room during the day, each student has approximately one hour of microcomputer time each week.

III. ORGANIZATIONAL ISSUES

Centralization and Decentralization

In Prescott, the administration and support of the microcomputers is highly centralized, although much of the actual use in the classrooms is left to the individual classroom teachers.

The initial microcomputers were part of a single Title IV-C project, to teach computer literacy in elementary and junior high schools. From that beginning, both the number and applications of the microcomputers expanded rapidly, under the guidance of the Superintendent's office and the original IV-C project staff. The directorship of that project (which changed hands after two years) has evolved into a formal, district-level position as coordinator of computer education. The centralized functions, directed by this coordinator, include:

- Hardware purchasing: All orders are initiated by teachers, but the coordinator sets priorities on orders and makes the purchases. This has enabled the district to limit itself to one standard brand of microcomputer.
- Allocation of hardware: The coordinator's policy is that all microcomputers belong to the district rather than to individual teachers or buildings. The microcomputers are rotated a great deal, both within buildings and between buildings to meet the needs of all the different users. However, some microcomputers are, in effect, permanently assigned to specific teachers, because the teachers make constant use of them. Then too, as the district acquires more microcomputers, less rotation is required.
- Software ordering, screening, reviewing, and distribution: Virtually all software purchases are coordinated by the coordinator of computer education. He personally screens many of the new programs when they arrive in the district, and requests reviews from others. In the summer of 1982, he organized a paid task force to review software, and he hopes to repeat this regularly. He also coordinates the distribution of new software to the different teachers and libraries in the district.

- Teacher training: Formal inservice training for teachers is an important part of the Prescott program, and this training is conducted or organized by the coordinator.
- Curriculum planning and development for computer literacy and computer science: The curriculum for the original computer literacy project has evolved in the past four years to include grades four through seven. This evolution is expected to continue under the supervision of the coordinator and other personnel, and eventually it should cover all grades (K-12).
- Test scoring and data processing: Prescott has testing procedures to measure achievement and attainment of district instructional objectives. In the past, scoring has been done by an outside service, and data processing has been done on the district's minicomputer system. The coordinator has developed an operational prototype system for the microcomputers that will score tests and process data. This new system will probably be used throughout the district.

The decentralized functions include all instructional uses of microcomputers outside of the district's computer literacy courses. All teachers are trained to select and operate software packages, and, to a large extent, they choose what they want from among the packages available in the district. Specifically, each special education teacher decides what uses will be made of the microcomputers.

Hardware, software, and curriculum support for the teachers is provided by the coordinator of computer education to the extent that he can find time. However, much of the current support comes from informal networks or individual teachers within the different schools. Teachers with the most experience and interest help those who are just beginning to use the microcomputers, so that much of the day-to-day support is decentralized.

Because of the widespread availability of the microcomputers, the teachers, school building administrators, and district administrators are beginning to realize the potential administrative uses of the microcomputers. At this point, the development of these administrative applications is largely decentralized.

The administration (and specifically the coordinator of computer education) is well aware of the trade-offs between

centralization and decentralization. The policy is to provide centralized support for the teachers, and the support system is being developed as rapidly as time and resources will permit. At the same time, the philosophy is to give the teachers a great deal of independence in actually using the microcomputers in their classroom.

The goal of the coordinator is to increase support substantially in four areas: (a) providing additional training programs for teachers and administrators, (b) creating workshops and seminars for microcomputer users to share experiences and ideas, (c) reviewing new software on a regular, formal basis, and (d) developing newsletters and other methods for communicating with users on a regular basis.

The role of the district's minicomputer system should also be considered in relation to the centralization-decentralization issue. In Prescott, the minicomputer system was purchased at about the same time as the first microcomputers were introduced into the district. The division of roles between the two types of computers had been established by a needs assessment committee headed by the assistant superintendent for business, who is in charge of the minicomputer system. This committee decided that all instructional applications should employ microcomputers, and that the minicomputer should be reserved for business uses. The assistant superintendent for business continues to hold this position, and supports the decentralization of the test scoring and processing as well. However, he points out the need for careful planning and coordination to prevent the inefficiencies that can occur when highly similar data bases are maintained separately in each school.

Special and Regular Education Interaction

Collaboration between special and regular education is extremely informal, and depends almost entirely on the relationships between the specific teachers involved. With one exception, the special education teachers have become involved in the microcomputer system relatively late (at the start of the third year, fall 1981), and they use the microcomputers for computer-assisted instruction, a relatively low priority in Prescott.

There was no specific plan for collaboration between the special and regular education users of the microcomputers. Some of the special education teachers took the early inservice training, and they have added microcomputers to the variety of other resources in their resource rooms. Purchasing, set up, and maintenance were handled by the coordinator of computer

education, along with all other microcomputer applications in Prescott (except for the new Special Education/Vocational Education diagnostic system that will use Apple microcomputers rather than the district-standard Commodore units.)

In practice, many of the special education teachers work closely with the regular classroom teachers in scheduling microcomputer lessons, just as they have always done when using other teaching methods. The special education teachers discuss the needs of their mainstreamed students with the regular classroom teachers and try to give the students practice in the skills they need for their course work. Specifically, they try to give the special education students drills on classroom spelling words and arithmetic skills.

Administrative and Instructional Applications

The original needs-assessment committee recommended that microcomputers be used for instructional purposes, while the minicomputer was to be used for the district administrative needs. Initially, this division was strictly maintained and all microcomputer uses originally instructional. As teachers and administrators gained familiarity with the capabilities of microcomputers, they have become interested in computerizing a number of tasks that have been done manually in the past. One of the major examples is in the Special Education/Vocational Education program. This program provides vocational training for special education students. It operates at one of the junior high schools, with junior high and high school students. The program has a Commodore PET microcomputer that is used for computer-assisted instruction in vocational training, but it is also being used now to create local norms for special education students.

In addition, Special Education/Vocational Education is currently developing a system of diagnostic programs for the special education students, using an Apple microcomputer. The diagnostic programs are part of a pilot project being conducted with the University of Arizona. This application is unique and is separate from other microcomputer uses in the district.

Other tasks are now being transferred to the microcomputers. A major example is the scoring and processing of the CUES tests. These are tests of the local instructional objectives, given twice a year. Arizona requires such a system, but the systems are locally developed. In the past, scoring was done in Phoenix, and data analysis was done on the district's minicomputer. Recently, the coordinator of computer education purchased several small mark-sense card readers and has developed programs to score the tests. The programs are being

pilot tested now and are planned for implementation in the fall of 1983.

There is also considerable interest in transferring attendance and scheduling functions to the microcomputers. The interest is in improving turnaround time and control over the tasks, but it is not clear how soon, if at all, the software can be obtained (or developed).

Finally, virtually all teachers who have made extensive instructional uses of the microcomputers are also interested in using the microcomputers for classroom management functions. Again, the problem is finding time for the coordinator or other interested personnel to locate or develop appropriate software, and to provide the training that the teachers will require.

In the meantime, the instructional uses of the microcomputers are continuing to expand. Microcomputer uses are also well established in special education programs, with computer science for gifted/talented students and computer-assisted instruction for special education and disadvantaged students. The computer literacy curriculum is now available for fourth through seventh grades, and computer science classes are being implemented for eighth and ninth grade students. The high school computer science course is well established, and there are long range plans to produce an integrated curriculum for all grades (K-12).

Training

The training program is a key feature of Prescott's approach to microcomputers. The major training course has been the introductory inservice course given twice a year since the beginning of the microcomputer project. The course is aimed at computer literacy and at preparing the elementary school teachers to teach the computer literacy course. The course is voluntary, but salary increment credits are given, and the local college gives course credit to the teachers. Over 200 of the 270 teachers in the district have taken the course, and more are signed up for future sessions.

Beginning in the second year of implementation (fall 1980) an advanced inservice course has been offered once or twice a year for teachers who want to learn more advanced programming. The focus is on developing computer-assisted instruction programs. About four or five teachers out of each introductory course have proceeded to the advanced course, and it has been given three times.

Also beginning in the second year, a literacy course based

on the elementary school curriculum has been offered to parents and others in the community. This course has been offered four times so far and has been fully and immediately subscribed each time.

Emerging Roles

The major new role that has been created in Prescott is the role of coordinator of computer education. This position evolved from the position of project director of the original Title IV-C microcomputer project. The original project director held the position for two years before leaving the district. At that time, the current coordinator was given a half-time position, while continuing to teach computer literacy half-time. Next year (1983-84), the position will be made full-time if the board approves the new budget. District commitment to the position is indicated by the fact that the coordinator already has an office (two rooms with a secretary) in the district office building.

Other new positions that have been created include computer science teachers at the two junior high schools. In addition, some pre-existing roles have been altered. The elementary school librarian has been very much involved in the microcomputer project from the beginning, and she has had responsibility for software in the five elementary schools. (There is one librarian with an office in the district building, plus an aide in each school library.) The software can only be checked out by teachers. In addition, each library has a microcomputer for use by the students.

Most elementary school teachers have added the teaching of computer literacy to their previous duties. Many teachers have added programming to their standard teaching tasks, but the major role changes have involved the consulting and support functions that several teachers have added. These teachers are the informal computer leaders in the various schools, and other teachers come to them for help on all aspects of computer use.

Other new functions that have been added include the review of software conducted by an ad hoc group of about a dozen teachers and students in June 1982. Similar review groups are planned for the future. In addition, several teachers have been involved in the development of the computer literacy curriculum.

The head of one junior high school math department has joined the coordinator in giving workshops around the state for other educators. The Special Education/Vocational Education coordinator has become involved in vocational education assessment in collaboration with the University of Arizona. Several

teachers are now getting involved in the new test scoring project using the microcomputers and card readers.

SHELBY CITY SCHOOL DISTRICT
Shelby, Ohio

Case Study Report

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The authors are grateful to Terry Russell, Superintendent, for granting permission for the Shelby City School District, to participate in this study. We would like to thank James Hunter, the Coordinator of Special Programs, for arranging the visit and assisting the research team on site. We also appreciate the assistance given us by all the other educators in Shelby who met with us and gave generously of their time to make our efforts successful.

I. SUMMARY NARRATIVE AND CHRONOLOGY

The School District

Shelby City School District encompasses roughly 58 square miles of Richland County, which has been described as the "industrial heart" of North Central Ohio. Most of the residents are employed in one of three large industries: Ohio Steel Tube Company, Shelby Business Forms, and Shelby Mutual Insurance Company. The Shelby community has a residential population of approximately 10,000, which has remained stable over the years although industrial unemployment is currently a problem. In general, community members describe Shelby as providing "small town life" with access to the larger cities of Columbus and Cleveland.

Shelby City School District is an autonomous district that currently serves 2,800 students in grades K-12. Almost all the students are white, with less than one percent minority. There are six schools: four elementary schools (one K-6 and three 1-6), one junior high school (7-8), and one senior high school (9-12). Also located within the district is a regional vocational school, which offers programs to 200 juniors and seniors from Shelby, as well as students from 14 neighboring districts.

Of the total student population, 210 students receive special education services. At the elementary school level, two of the schools house all the self-contained special education classrooms. The junior high school has two special education classrooms and the senior high school has a learning disabilities resource center and two special education classes for students identified as developmentally handicapped.

However, there are not enough special education students to warrant a full-time position for directing special education services. At one time, the assistant superintendent was responsible for special education services, but that position was eliminated in 1982. Presently, the administration of special education is shared among three people. First, the high school guidance counselor is responsible for some special education services--e.g., mailing referrals and IEPs for the entire district, attending regional meetings, and generating reports. Second, the coordinator of special programs handles the funding and accounting for the special education programs and all material and equipment requests. (Both of these people report directly to the Superintendent.) Third, the district psychologist is responsible for most of the testing, screening, and placement of special education students, and he reports to the

guidance counselor. In none of these cases is the special education responsibility a full-time position.

In addition, the district contracts with the county for a special education supervisor to work directly with the special education teachers on curriculum development and to serve on student placement committees. The position is a resource to the teachers but carries no line authority. The district's ten special education teachers (seven elementary, three secondary) are supervised by their principals, who in turn report to the Superintendent.

The students in the Shelby schools have access to a total of 18 microcomputers. The units are located in all six schools. In addition to these microcomputers, the district has access to a Burroughs mainframe computer at the regional vocational school through two terminals in the district office. The mainframe is used by the district administration to schedule secondary school programs and to support the district's budgeting and accounting systems.

Overview of Microcomputers Studied

Microcomputer applications in Shelby vary across schools and among individual classrooms, reflecting the interests and objectives of the users. Of the 18 microcomputers in the district, 13 (8 TRS-80, 4 Commodore, and 1 Apple) are located in the elementary schools. These are used with gifted/talented, special education, and fifth and sixth grade students. There are three microcomputers (two Apple II-Plus, and one TRS-80) at the junior high school, used only with the special education and gifted/talented students. The senior high school has two microcomputers (two Apple II-Plus), one for the senior computer class and the other in a special education classroom.

The microcomputer applications are primarily instructional with only very limited administrative uses by a principal and senior high school science teacher. Examples of microcomputer use are:

- A sixth grade class uses a self-directed programming course, "Meet the Computer," which is a set of card files that teaches programming through a sequence of computer activities.
- A special education classroom in the senior high school has a microcomputer that is used by the students for drill-and-practice games. The microcomputer is seen primarily by teachers as

an instructional tool for remedial work in basic skills.

- Two sixth grade classrooms each have a microcomputer which is scheduled for use by all of the students every week. Students use it for computer-assisted instruction (drill-and-practice) in math and reading with some opportunity to play games such as backgammon and micro-chess.
- At the junior high school, the gifted/talented students are given six weeks of programming instruction using high-resolution graphics on a TSR-80 Color Computer.
- One elementary school principal uses a microcomputer in his office for staff information and evaluation files. During the teacher review conferences, the information is displayed on the computer monitor to facilitate discussion between the principal and the staff member.
- Another elementary school principal has a microcomputer in his office which is used by the gifted/talented students for their before-school program. Students, in pairs, are rotated through his office during the week to learn the writing of basic programs or to play popular microcomputer games such as backgammon and blackjack.
- A Senior Computer Class is offered to twenty students each semester, to learn computer awareness and basic programming. One microcomputer is used for demonstration purposes, with students scheduling individual time for programming assignments.

Chronology

The district's first microcomputers, five TRS-80 (Model I's), were purchased in the summer of 1980 with funds from an ESEA Title IV-C grant. The grant proposal was written by the principals and several teachers from two elementary schools. The aim of the grant was to provide the gifted/talented students with computational drill-and-practice and with experience in microcomputer operation and programming. The project funds also supported the purchase of software.

As use of the microcomputers became more visible in the

district during the 1980-81 academic year, the other two elementary schools decided to purchase microcomputers with gifted/-talented supply funds and Title IV-B monies. At the same time, staff at the junior high school realized that the sixth graders who were learning from the elementary classes would have nothing to expand their skills upon when they reached the seventh grade. Consequently, Title IV-B funds were used to acquire a TRS-80 color microcomputer. The funding was arranged by the coordinator of special programs who had taken an interest in expanding microcomputer use in the district.

A year later, staff at the senior high felt that a microcomputer was needed, to enable the incoming students to continue their programming work. Also by this time, computer use had expanded in some schools beyond the small numbers of gifted/-talented students, as individual teachers began to acquire more software and see the advantages of using the microcomputers for instructing all of their students.

The first microcomputer for special education was purchased at the request of a special education teacher in one of the elementary schools in the winter of 1981-82. The coordinator of special programs began at this point to use more of the Title VI-B federal funds to acquire microcomputers for the other special education classrooms. As funding became available during the 1982-83 academic year, microcomputers were provided to one special education classroom in each of the junior and senior high schools, as well as to another elementary school special education classroom.

The growth and expansion of microcomputer use and applications in the district has been primarily at the initiative of individual, interested teachers and principals. During the early implementation, no district-wide inservice training was available. However, one school used a consultant, under the original funding proposal, to provide several brief inservice demonstrations. Most of the teachers were either self-taught or only knew the rudiments of operating microcomputers. It was the previous Superintendent's strategy, according to the coordinator of special programs, to provide a "facilitative, not directive, atmosphere" by providing microcomputers, but allowing those interested to seek their own training. However, the absence of training, combined with a lack of software, resulted in underuse of microcomputers in some schools. Currently, units at two elementary schools are underused, either because they are new and have not been allocated to teachers, or because there is no strong interest or direction for utilizing them.

It is the responsibility of individual principals to provide direction and coordination regarding the use of microcomputers in their schools. The principals, in turn, may dele-

gate the development of specific applications to the discretion of individual teachers. Apart from the coordination of funding by the special programs director, the scheduling, training, maintenance and software purchases are channeled through the principals, whose interest and involvement vary at each site.

The lack of district-wide coordination and direction has not gone unnoticed. A Computer Committee was organized in January 1983, with representatives from each school. The committee has begun to address the need for a K-12 computer course of study and a system-wide agreement on the future purchase of hardware and software.

Major events in the history of microcomputer implementation in the Shelby City School District are presented in Table 1.

Table 1: Chronology of Implementation

Shelby City
School District

Date Month	Event
<u>1979-1980 Academic Year</u>	
Feb. 1980	Resubmission of ESEA Title IV-C proposal (Project INPUT) requesting five microcomputers and software.
April 1980	Awarded ESEA Title IV-C grant for computer project.
July 1980	Purchased five TSR-80 Model 1 (4K & 16K) and starter software packages.
<u>1980-1981 Academic Year</u>	
Nov. 1980	Teacher inservice with consultant at two elementary schools (10 weeks - 30 hours).
Dec. 1980	Purchased one TRS-80 Color Extended Basic unit.
March 1981	Purchased two TRS-80 Model I microcomputers.
June 1981	Summer course offered in BASIC programming for grades 4-9 (1 week - 15 hours).
<u>1981-1982 Academic Year</u>	
Sept. 1981	Purchased one Apple II-Plus.
Sept. 1981	Shelby Super Saturday courses offered in computer literacy and basic programming for grades 3-9 (6 weeks - 12 hours).
Dec. 1981	Purchased one TRS-80 Model III and one Apple II-Plus.

Feb. 1982

Upgraded original TRS-80 Models to 48K capacity and purchased one 16K TRS-80 Model III.

1982-1983 Academic Year

Sept. 1982

Upgraded 16K TRS-80 to 48K capacity and equipped with dual disk drive and printer.

Nov. 1982

Purchased one Apple II-Plus with dual disk drives and printer.

Nov. 1982

Teacher inservice at one elementary school on computer literacy (6 weeks - 12 hours).

Jan. 1983

Computer Committee formed to establish district directions for computer program.

Jan. 1983

Compiled district-wide listing of software.

Jan. 1983

District teacher inservice with computer workshop (1 hour).

Jan. 1983

Purchased one Apple IIe microcomputer.

Feb. 1983

Purchased one disk drive for each elementary school.

II. FEATURES OF THE MICROCOMPUTERS

Introduction

There are 18 microcomputers of differing hardware types in the district's six schools. The four elementary schools have 13 of these microcomputers. One elementary school has three TRS-80 models, equipped with cassette players, located in the fifth and sixth grade classrooms. A second elementary school has two TRS-80 models, allocated to a special education classroom and to the gifted/talented resource room. A third elementary school, in addition to two TRS-80's, has recently acquired four Commodore 64's with tape recorders. These microcomputers are located in the fifth and sixth grade classrooms, with the exception of one unit in the principal's office. The fourth elementary school has one TRS-80 Model I unit and one TRS-80 Model III unit, located respectively in the principal's office (for use by the gifted/talented students) and in a special education classroom.

At the junior high school, there are three microcomputers: one Apple II-Plus with disk drive and printer, one Apple IIe with disk drive, and one TRS-80 Color Extended Basic unit. One of the computers is located in the principal's office. The senior high has two Apple II-Plus microcomputers, both with disk drives and printers. One computer is used for a senior computer class and is in a storage room of the science department, the other microcomputer is located in a special education classroom.

Management of the Microcomputers

Most of the microcomputer purchases, including those for special education, have been managed by the coordinator of special programs, who is responsible for all federal and special funds. The purchases were all approved by the Superintendent and school board. In some cases, the initial decision to adopt microcomputers for special education classes was made by the coordinator, and not by the special education teachers. Several special education teachers indicated that they were directed to use microcomputers in their classrooms. One microcomputer purchase occurred against the expressed wishes of two special education teachers.

The purchase of microcomputers for regular education and gifted/talented students has also been handled by the coordinator of special programs when the use of federal or special funds has been involved. However, when independent funding was used--such as proceeds from school fund-raising events or P.T.O money--principals have independently purchased

microcomputers and made independent decisions regarding the use of the equipment.

Apart from purchase and allocation, the district has no single person responsible for coordinating the implementation or use of the microcomputers. Once microcomputers are allocated to a school or an individual teacher, decisions regarding software, training, and scheduling are left to the teachers and principals. In general, software requests and hardware maintenance are the responsibility of the principals. Thus, the extent of use reflects the leadership, support, and direction of principals or teachers.

A newly-formed computer committee is beginning to question the lack of district-wide coordination and the isolated adoption of different hardware. With representatives from each school, the committee plans to develop district guidelines for hardware and software purchases and to develop a computer program encompassing all grade levels. The committee has the authority to make recommendations directly to the Superintendent.

Illustrative Applications

To provide an idea of how the microcomputers are being used in the Shelby schools, two illustrative applications are described below.

CAI/CMI in High School Special Education Classroom. A special education teacher was excited about the possibility of using computer programs to develop the eye/hand coordination skills of her 17 special education students. Given the choice between an aide and a microcomputer, she chose the microcomputer.

The microcomputer, a TRS-80 Model III with dual disk drive and line printer, is located at the back of her classroom in a "Computer Center" along with other audio-visual equipment. As students complete their "seat work," they take turns using the computer for at least 30 minutes daily. Students are allowed to work independently at the microcomputer after receiving operating instructions and program demonstrations from the teacher. However, only certain students are allowed to load the disks and use the printer because of some earlier abuse and damage. According to the teacher, students respect this arrangement, as they do not want to be denied access to the microcomputer.

The most frequently used program package is the Radio Shack series of computer-assisted instruction (CAI) software in mathematics for grades K-12. It has a student management capability (computer-managed-instruction) that allows automatic

progression (and return) from one lesson to the next, and records each student's progress in a skill area. Students also use the microcomputer for a variety of educational game programs that focus on motor coordination or specific skills such as vocabulary and grammar. In addition, the microcomputer is used for the class's "alfalfa sprout business." All the business accounts and records are kept on the microcomputer. Shares of stock are sold in the company. The microcomputer was used to type and print letters to the stockholders who received an annual dividend check of four cents per share.

Individualized Instruction/Tutoring in an Elementary School. At one elementary school, fifth grade students are involved in a tutoring program. Two mornings per week, the school's three TRS-80 microcomputers are moved to a location in the hallway. Half of the students in the class report to the reading teacher who tutors them in reading, and the remaining fifth graders are involved in the microcomputer tutoring program.

Each fifth grade student is teamed with one first grader. Each team works together for 15 minutes, using a math program written by the fifth grade teacher after his review of the first grade math text. Teams share the microcomputers, and three teams can be working at any given time. Each fifth grader works with the same first grader for a five-week session. The fifth grade students are proud to show the first grade teacher how their "students" are doing. The fifth grade teacher keeps the print-outs of student progress. Students are presently participating in the first five-week series. During the next series the teacher will give his fifth graders additional instructions in order for them to further direct their "charges" on how to use the microcomputer.

III. ORGANIZATIONAL ISSUES

Centralization and Decentralization

The first microcomputers in the district were purchased through ESEA Title IV-C funds. Their use was shared and coordinated by staff at two elementary schools, to provide gifted/talented students with math computation drills and experience in microcomputer operation and programming. Since this initial coordination between two schools during the Title IV-C project, the subsequent expansion of microcomputer use in the district has been very decentralized. In successive years, additional microcomputers were purchased for the remaining two elementary schools, followed by purchases for the junior and senior high schools. Most purchase requests were initiated by interested teachers and their principals. Purchasing decisions have been made at the building principal level, unless federal funds were used for the purchase.

When purchases involved federal funds, requests were directed to the coordinator of special programs. His decisions are approved by the Superintendent. His early involvement with administration of the first federally sponsored project involving microcomputers (Title IV-C), coupled with his responsibility for administering federal funds, led to individuals seeking him out with their microcomputer requests. Nevertheless, this responsibility has not been added to his formal job description. He has also been very instrumental in providing microcomputers for special education. Several units were purchased for special education classrooms with available federal funds. All procedures, however, regarding scheduling of use, maintenance, security, and software purchases, have been determined by individual principals and teachers.

There have been two district-wide, one-hour inservice training sessions on microcomputers, and one county-wide, two-hour inservice on computer use. However, most training is left primarily to the individual teachers, whose interest and initiative determines whether they teach themselves, take an outside course, or get some training from other, more experienced teachers. The teachers using microcomputers to teach programming at the junior and senior high schools have taught themselves and developed their courses independent of each other. Different types of microcomputers were purchased separately by the schools. As microcomputer use has expanded to include CAI as well as programming, software purchases have become necessary. Staff at the schools have now become aware of significant software incompatibility problems, as they attempt to share software and information between buildings.

Teachers are also concerned with a question of efficiency--how much of a student's time is spent becoming acquainted with several different kinds of microcomputers, as the student progresses from elementary, to junior, to senior high schools. Because of this evolution, the Shelby staff and the Superintendent felt that additional coordination would be valuable. In January 1983, a Computer Committee was established. The establishment of a committee is characteristic of administrative practices in the district. There are at least seven committees that report to the Superintendent on issues ranging from district philosophy to inservice training. The structure and process of the Computer Committee is similar to the others. The committee chairperson is a principal who was appointed by the Superintendent. Committee members include the coordinator of special programs, as well as principals and teachers. Interested principals and teachers from all the schools were encouraged to become members. There is presently at least one person representing each of the Shelby City schools.

Members of the committee feel that they are at a crossroad and may need to decide on one type of hardware for all future purchases. No procedures for hardware/software acquisition have been determined yet, and all purchases are essentially on hold. It is expected, however, that software/hardware purchase recommendations will be made before the end of the school year, in order not to lose available federal funds.

The introduction of the microcomputer has not affected mainframe applications in the district. These include budgeting, secondary scheduling, payroll, and secondary attendance. (The district presently uses the Pioneer Computer Consortium at the regional vocational school for these services.)

Special and Regular Education Interaction

No particular collaboration between regular and special education teachers occurred during the initial implementation of microcomputers in the district. This is the first full school year that both regular and special education teachers have had microcomputers, and they are still working in relative isolation from one another. All microcomputers presently being used by the special education teachers were purchased with special education funds. This has obviated the need for shared usage discussions between regular and special education teachers. One special education teacher who is particularly enthusiastic about computer-assisted instruction has been working on her own initiative to get other sixth grade teachers in her building interested in microcomputers. She has loaned out her microcomputer to one interested teacher and has set up demonstrations for the

other teacher's students.

At the present time, gifted/talented and special education students have more opportunity for microcomputer use than other students. There were no indications that regular education teachers without microcomputers feel that they have been left out. The teachers who are presently most interested in using microcomputers already have them. This is reflected in the number of microcomputers (more than three) that are available in some schools and are not regularly checked out by teachers for classroom use.

The special and two regular education teachers using microcomputers at the high school have begun an informal relationship for sharing information, software, and microcomputers. The special education teachers at this school cannot accommodate requests by the regular education teachers to use the special education computer for periods during the day. Microcomputers bought with special education funds must be located in special education classrooms. Students assigned to those classrooms have first priority for use of the microcomputers. If no special education students need the microcomputer, a regular education student can use a special education microcomputer on a casual basis.

Administrative and Instructional Applications

The present applications of the microcomputers are primarily instructional. The first microcomputers in the district were purchased through a grant which designated their use for instructional purposes. Subsequent purchases have been a result of teachers' requests for instructional use, or of the coordinator of special program's interest in using EHA Title VI-B funds to establish computer-assisted-instruction in special education programs.

One principal shares a microcomputer with his teachers and uses it for an administrative application: storing personnel information and displaying staff evaluation summaries during individual teacher conferences. He is the only administrator presently using a microcomputer in this way.

Several principals have expressed an interest in future administrative applications. One principal feels this is at least five years away, and the Computer Committee is only giving attention to instructional issues. One principal uses a microcomputer rather extensively but only for instructional applications. He conducted a six-week course in computer literacy for 12 interested teachers. The course was held twice each week before school. He is presently going into classrooms (grades

two through six) for five-week demonstrations that are arranged with individual teachers.

One principal has a computer in his office while he is learning to use it so he can teach other teachers. Another principal has one in his office for use by gifted/talented students because there is no other space available. All of these additional uses by principals reflect instructional rather than administrative applications.

The existence of the mainframe (time-sharing) services for budgeting and scheduling does not preclude administrative applications with microcomputers. Rather, the growth of such usage is limited by the availability of microcomputers, and by the time and training required to determine how to implement effective administrative applications. The Superintendent related that, although he personally would not have the time to use a microcomputer, at least one person at the district office is interested. Alternatively, he felt that purchase of a microcomputer for the district office would not be well received at this time. Rather, any microcomputers purchased should be made available to the students. The Superintendent also related that teacher representatives with access to a microcomputer appeared to have an advantage during budget/salary negotiations with the school board. This was due to their quick ability to produce spread-sheet data on personnel and expenses.

Training

During the Title IV-C Project, the school board paid for a ten-week training course taken by the first five persons in the district to use microcomputers. Since that time, there has been very little district-sponsored training, and most users are self-taught. It was the Superintendent's strategy, according to the coordinator of special programs, to only provide microcomputers to interested teachers and, thereby, to encourage them to generate their own pressure to learn. There have been two district-wide inservice meetings attended by approximately 12 teachers but lasting only one hour each. In addition, there was one county-wide inservice on microcomputer use. All four of the users at the high school are self-taught. One of the junior high users is self-taught. The other user has taken an "Apple II and YOU" course at the local technical college.

One elementary principal has taken courses at Radio Shack. He conducts before-school training sessions for interested teachers at his school. He simultaneously encourages his teachers to use the one microcomputer that is available for general use at his school. Another principal is hoping to offer more training through a free program sponsored by Radio Shack.

Several teachers at one school have taken a course at the local technical college and several teachers at another school are presently taking a course at the regional vocational high school. Some teachers are not aware of any training available to them.

There is no formal mechanism that would allow those who learn about outside training at one school to share that information with interested staff at other schools. Some teachers who have not received formal training have been interested enough in the microcomputer to teach themselves programming. They then go on to introduce programming to their students. For others, however, the implementation experience has not been as satisfactory and, according to some teachers, has been marred by the lack of training and software.

In some instances, microcomputers were assigned to teachers who were not highly motivated to use them. Several of these teachers do not know how to load diskettes. They have little or no software and don't know what to order or whether there is money for software. Several teachers said that they were able to use commercial software and had taught their students how to load the microcomputer. However, they felt that they were probably misusing the microcomputer because they didn't know how to program it as other teachers did.

Emerging Roles

No new roles have been formally created to coordinate the implementation of microcomputers in the district. The coordinator of special programs has been instrumental in securing microcomputers through various federal funding sources. His activities were, however, limited to his financial role in securing microcomputers and related materials. He continues to be sought out for information about federal funding possibilities for microcomputers. Most administrators and teachers felt that his responsibilities did not include coordination of the microcomputer applications. Building principals have assumed primary responsibility for microcomputer use and maintenance.

The recently formed Computer Committee, chaired by a principal, will draft recommendations regarding coordination functions as part of their recommendations to be submitted to the Superintendent for approval. It is not anticipated that coordination responsibilities will be delegated to any one person in the district.

There have been no additional salaries to any school personnel for microcomputer related activities during the school

year. There are no indications that this will change. Some of the teachers have served as instructors at the two district-wide inservices. Also, several teachers instruct students in micro-computer classes on "Shelby Super Saturdays."

MADISON PARISH SCHOOL SYSTEM
Tallulah, Louisiana

Case Study Report

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I. SUMMARY NARRATIVE AND CHRONOLOGY

The School District

The Madison Parish School System is located in extreme northeast Louisiana, on the bank of the Mississippi River. The school district's administrative offices are located in the town of Tallulah, which is the parish seat and largest town. The residential population served by the school system is approximately 13,000. The economy of the district is agriculturally based and, until the mechanization of farming in recent years, was dependent on manual labor. With the decline of needed labor and the absence of alternative employment opportunities, the rate of unemployment is 18-19 percent in this area. Presently, the school district is the largest employer in Madison Parish.

The student population of the school system is 3,800, slightly less than previous years. Ninety percent of the students are Black, and 95 percent of all the students qualify for compensatory education funds. The Madison Parish School System consists of ten buildings: three administrative offices and seven school sites. One of the administration buildings is for central district functions, one is for Title I functions, and one building contains the special education services. Five of the schools--two elementary, one junior high, and one senior high--are located in Tallulah. The other two schools are a K-12 school located in Thomastown and an elementary school in Waverly.

The special education program in the district has expanded during the last five years from 3 to 16 resource and self-contained classrooms, now serving approximately 380 students. In addition to the 16 special education teachers in the schools, there are three preschool teachers, who conduct home visits and early evaluation activities, and four speech therapists. The special education program also employs a school psychologist, a social worker, and an assessment teacher, who are responsible for pupil evaluation and placement recommendations. The supervisor of special education coordinates and manages the entire special education program in the district. He reports directly to the Superintendent.

All of the microcomputers in the school system are used for either administrative or instructional special education activities. In the special education administrative offices, there are two Intertec Compustar microcomputers used by the supervisor. Ten microcomputers (one TRS-80 and nine Commodore PETs) are distributed in special education classrooms throughout the district. In addition, two Franklin 1200 and six Franklin 1000

microcomputers have been purchased for a basic skills lab at the junior high school.

Overview of Microcomputers Studied

The microcomputers chosen for the focus of this study are the two Intertec Compustars located in the special education administrative office. The units are used exclusively by the supervisor of special education for administrative applications. The microcomputers are used for data base management, word processing, and other administrative software packages. Examples of administrative use include:

- The monitoring of students' Individualized Educational Plans (IEP);
- Notification letters to parents for IEP conferences;
- Student data records for forms and reports;
- Inventory of special education materials and equipment;
- Word processing for the Special Education Policies and Procedures manual;
- Listing of microcomputer equipment in district with locations and acquisition dates;
- Special education accounting with budgeted items and list of expenditures;
- Annual special education and speech reports.

Chronology

Microcomputer technology was introduced into the Madison Parish School System by the supervisor of special education in 1977. The supervisor had become interested in the possibilities of microcomputer technology from an article in a Popular Mechanics magazine. After purchasing a DMS microcomputer for his personal use at home, he soon realized the applicability of the microcomputer for special education functions. He started by using his home computer for storing demographic data on special education students with a data base management program and for developing report formats with word processing. At approximately the same time, a special education supervisor in a neighboring district was exploring microcomputer use, so the two

supervisors began to exchange ideas informally.

The Madison Parish supervisor decided to approach the school board about the possibility of the parish purchasing a microcomputer for special education services. Convinced of the feasibility and cost effectiveness of using a microcomputer in their small, rural parish, the school board approved the acquisition of one unit. Based on the supervisor's evaluation of available hardware and bid results, one Intertec Compustar and printer was purchased in the fall of 1979, using federal special education funds.

A second Intertec Compustar was added to the special education office in the fall of 1982, using additional federal special education funds. Both microcomputers are used extensively by the supervisor of special education for a variety of administrative tasks.

In addition, the supervisor developed a comprehensive tracking system for the special education students in the district. The local company that assisted in the design of the software has sold the program to 14 other districts in the state. The supervisor of special education was involved in the implementation of the system in the other school systems. He often makes presentations and holds inservice training in the neighboring districts. The microcomputers in Madison Parish are connected by modem to another district's microcomputer so the special education supervisors can exchange information and resources. In the fall of 1983, the Madison Parish School System will be participating in a pilot project to implement a statewide computerized student tracking system similar to the existing microcomputer program.

Apart from his involvement in the implementation of administrative microcomputers in the special education office, the supervisor was instrumental in acquiring microcomputers for instructional use in special education classrooms. The supervisor coordinated the purchase of ten microcomputers (nine Commodore PETs and one TRS-80) and software, using special education curriculum funds. He is responsible for managing the use of the microcomputers, including maintenance, training, and technical assistance. It must be noted, however, that the microcomputers for instruction are entirely separate in their management and use from the units for administration.

The major events in the implementation of administrative microcomputers in the Madison Parish School System are presented in Table 1.

Table 1: Chronology of Implementation

Madison Parish
School System

Date Month-Year	Event
<u>1977-1978 Academic Year</u>	
Fall 1979	Supervisor of special education purchases microcomputer for home use and develops reports and forms for special education.
<u>1978-1979 Academic Year</u>	
March 1979	Approval granted by school board to purchase one microcomputer for special education services.
<u>1979-1980 Academic Year</u>	
Sept. 1979	Purchase of one Intertec Compustar and printer with federal special education funds.
<u>1980-1981 Academic Year</u>	
Sept. 1980	Presentation on administrative applications of microcomputers at two state conferences by supervisor of special education.
Fall 1980	Course offered to administrators and teachers on microcomputer applications through the Professional Improvement Program Points.
Spring 1981	Supervisor of special education provides inservice to other school districts.
<u>1981-1982 Academic Year</u>	
<u>1982-1983 Academic Year</u>	
Sept. 1982	Purchase of one Intertec Compustar and printer for special education services.

II. FEATURES OF THE MICROCOMPUTERS

Introduction

Presently, the special education administrative offices have two Intertec Compustar microcomputers. Both units are equipped with disk drives and printers (one dot matrix and one NEC 7710 letter-quality printer). One of the microcomputers is located behind the clerical aide's desk for data entry purposes. The other unit is placed behind a room divider in the rear of the office, creating a separate workstation for the special education supervisor's use.

The microcomputers are used on a daily basis by the special education supervisor and the clerical aide. The supervisor estimates his use to be approximately three hours daily and the aide's use (of the other unit) four hours daily.

Management of the Microcomputers

As the primary user of the microcomputers for special education administration, the supervisor of special education is responsible for all aspects of their use. He handles the funding and purchasing decisions, installation, maintenance, and software acquisitions. The supervisor is responsible for keeping the Superintendent and school board informed of his microcomputer activities.

In addition, the supervisor has been instrumental in assisting the other microcomputer adopters in the district. He was responsible for purchasing the microcomputers for instructional use in special education classrooms. As a result, he provides coordination and technical assistance for these units. The supervisor has the only computer expertise in the district, so he informally serves as the "microcomputer specialist" for the entire district. In the absence of planning groups or committees, the supervisor has acted alone in guiding the adoption and expansion of microcomputer use in the Madison Parish School System.

Illustrative Application

To provide an idea of how the microcomputers are being used for special education administration in Madison Parish, one illustrative application is described below.

Student Tracking System. The administrative tracking system for special education students represents the most unique application in the district. The program was custom-designed by a programmer with MicroTechnology, in conjunction with the supervisor of special education. It is a Modular Software System, set up to handle general business and fund accounting in addition to the special education student tracking. (The program allows a user to purchase only the needed modules, with the option of adding other modules later.)

The Special Education module is used to create and maintain files about students in special education programs. Optional routines include capabilities for adding, examining, listing, and deleting the student records. The supervisor uses the computer files to enter data on the progress of students. He is then able to print a variety of reports such as IEP revisions, dates, pupil appraisal summary reports, evaluation process reports, and principals' Special Education Reports. Also, detailed reports can be printed showing the status of each student and the students needing updates of their records.

Since the implementation of the program in the Madison Parish School System, approximately 14 other districts have purchased the software package along with an Intertec Compustar microcomputer. The supervisor is recognized as the initiator of this program and often travels to other districts to provide consulting and training.



III. ORGANIZATIONAL ISSUES

Centralization and Decentralization

The microcomputers used for special education services in the Madison Parish School System are highly centralized with regard to their adoption, implementation, and use. The decision to adopt was made by the supervisor of special education, who was interested in the microcomputer's capabilities for administrative tasks. On his home computer, the supervisor began using a data base management program for student records and a word processing program for office forms and reports. It was based on his experience and knowledge that the school board approved the purchase of Intertec Compustar microcomputers with federal special education funds.

As the primary user, the supervisor of special education has complete control over the location, scheduling, and use of the two microcomputers. The units are designated exclusively for administrative use in special education. The supervisor has been responsible for obtaining all the software programs as well as having new programs designed for specific administrative functions. He alone decides on which applications to use in the delivery of special education services. The supervisor is continually expanding the microcomputer activities with recent additions including accounting, a student tracking system, forms, manuals, and equipment inventories.

In the adoption of microcomputers for instructional use, the supervisor of special education purchased a separate system, operated independently of the microcomputers for administrative purposes. The instructional microcomputers are a different type of hardware and only use instructional software. Even though the instructional microcomputers represent a separate system, they are also centralized in terms of purchasing decisions, software acquisition, location, and applications. The supervisor handled both the acquisition of the microcomputers with special education funds and the allocation of the units to special education resource rooms. Use of the microcomputers is identical in each resource room because teachers have the same software programs for computer-assisted instruction in basic skills.

Special and Regular Education Interaction

The use of microcomputers in the Madison Parish School System has not affected the pattern of collaboration between regular and special education. The two Intertec Compustars are

used exclusively for administrative purposes in the special education services office. In part, their use is restricted to special education because they were purchased with federal special education funds.

In planning for implementation, the supervisor of special education acted alone except for final approval given by the school board. The supervisor is responsible for all aspects of the microcomputers, including acquiring software, developing new applications, self-training, and maintenance. In addition, by being the only user, except for his clerical aide, the need for collaboration is not even an issue.

The supervisor of special education also is responsible for the microcomputers used for instructional purposes. These units were purchased with special education funds and allocated only to special education resource rooms. As a result, regular education is not involved in any microcomputer use in the district.

Administrative and Instructional Applications

In adopting microcomputers, the supervisor of special education planned only for administrative applications in special education services. No consideration was given to regular education administrative applications or instructional uses. The supervisor's priority was to computerize the recordkeeping and other administrative tasks needed for tracking, evaluating, and reporting on special education students. The supervisor adapted existing software such as data base management and word processing programs for some administrative functions specifically for special education. One software program was custom-designed by a local programmer for a comprehensive tracking system for special education students.

The original administrative uses of the two microcomputers are continually developed and expanded as more programs become available and more capabilities of the microcomputers for special education services are recognized. The data base management program first used by the supervisor now includes student demographic information, IEP planning and placement committee dates, student evaluation time-lines, federal special education counts, and reporting requirements. The word processing program is used for annual reports as well as over 60 forms and manuals for special education, such as parent notifications, annual conferences, IEP reviews, and reimbursement reports. The custom-designed, comprehensive student tracking system has been adopted by 14 other districts in the last two years.

A separate set of microcomputers (nine Commodore PETs and one TRS-80) exists for computer-assisted instruction in the

special education resource rooms. There is no overlap in terms of use, software, scheduling, or location between the instructional microcomputers and the units in the special education office. The microcomputers and software for instructional use were purchased with state special education funds that are designated only for classroom purposes. Consequently, there was no conflict in allocating resources to two different sets of microcomputers.

Training

No training was necessary for the implementation of the two microcomputers for special education services. The supervisor of special education is the primary user of the equipment and using a computer at home, taught himself both computer operations and programming. He has developed all the administrative applications for special education by either adapting commercial programs or collaborating on the design of new software. The supervisor has informally trained his clerical aide in computer operations for entering data into programs.

The supervisor's microcomputer expertise has been important to other districts adopting similar microcomputer systems for administrative applications. Often, the supervisor provides inservice training and workshops to neighboring districts on a need basis. In addition, he made several presentations at state conferences on the use of microcomputers in special education administration.

Training for the use of microcomputers in special education instruction has been provided by the supervisor of special education. An inservice session on computer operations was offered for the special education teachers when the equipment was first placed in the resource rooms. The only additional training has been provided through the Professional Improvement Program Points in the district. Teachers can participate in five-hour workshops taught by the supervisor and receive credit for salary increases. The training focuses on computer applications in instruction and on BASIC programming. The supervisor admits that the training for teachers has been minimal because it is an additional demand on his time.

Emerging Roles

No new organizational roles have been created due to the implementation of microcomputers in the district. The supervisor of special education was the only person involved in the planning and adoption of microcomputers in special education services. He describes his involvement in implementing micro-

computers as a personal interest that has enabled him to organize and administer special education services more efficiently.

Since the supervisor has the only computer expertise in the district, he has informally assumed the role of computer specialist but it is not an official part of his position. For the central administrative office's microcomputer, the supervisor was instrumental in the purchasing, installation, training, and continues to provide technical assistance to its users. The supervisor was responsible for the purchase of the microcomputers and software for instruction, and continues to manage the system in terms of maintenance and technical assistance.